FICHTNER

Consulting Engineers Limited

Charlton Lane Eco Park

SUEZ Recycling and Recovery Surrey Ltd

Dispersion Modelling Assessment

ENGINEERING + CONSULTING

Document approval

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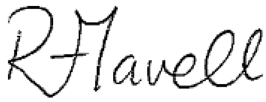
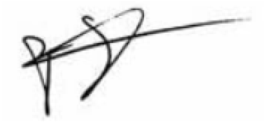
Prepared by:	Rosalind Flavell		Senior Consultant	07/12/2022
Checked by:	James Sturman		Lead Consultant	07/12/2022

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Management Summary

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged by SUEZ Recycling and Recovery Surrey Ltd to undertake a Dispersion Modelling Assessment to support the application for a variation to the Environmental Permit (EP) for the Charlton Lane Eco Park (herein referred to as the Facility). Full details of the proposed changes being applied for can be found in the Supporting Information document submitted with this application.

Dispersion Modelling of Emissions

The ADMS dispersion model is routinely used for air quality assessments to the satisfaction of the Environment Agency (EA). The model uses weather data from the local area to predict the spread and movement of the exhaust gases from the stack for each hour over a five-year period. The model takes account of wind speed, wind direction, temperature, humidity and the amount of cloud cover, as all of these factors influence the dispersion of emissions. The model also takes account of the effects of buildings and terrain on the movement of air. To set up the model, it has been assumed that the facility operates for the whole year and releases emissions at the emission limits proposed continuously. The model has been used to predict the ground level concentration of pollutants on a long-term and short-term basis across a grid of points. In addition, concentrations have been predicted at the identified sensitive receptors.

Approach and Assessment of Impact on Air Quality – Protection of Human Health

The dispersion modelling has been used to predict the impact of emissions on air quality for the Permitted and Proposed Facility for the following scenarios:

1. Operation of the gasification plant and biogas engines – standard operations
2. Operation of the gasification plant only;
3. Operation of the biogas engines only;
4. Operation of the flare only; and
5. Operation of the gasification plant, biogas engines and flare.

Under standard operations the gasification plant and biogas engines would operate, they would emit via a common windshield, as such the dispersion is aided by the other source. To fully demonstrate the impact of these sources operating in isolation scenarios 2, 3 and 4 have been considered.

The air quality impact on human health has been assessed using a standard approach based on guidance provided by the EA. Using this approach, in relation to the AQALs set for the protection of human health the following can be concluded from the assessment.

1. There is predicted to be a slight decrease in impacts as a result of the proposed variation. This is attributed to the increase in velocity which offsets the increase in the release rate of pollutants.
2. Emissions from the operation of the Facility will not cause a breach of any AQAL.
3. In all instances the long-term PEC is below 70% of the AQAL and therefore there is little risk of the PEC exceeding the AQAL.
4. There is no risk of exceeding an AQAL for any metal either on a long-term or short-term basis.

5. The impact of the operation of the flare cannot be screened out as 'insignificant'. However, not "insignificant" impacts are restricted to close proximity to the installation boundary and the additional contribution at residential properties is minimal.

Approach and Assessment of Impact on Air Quality – Protection of Ecosystems

The impact of air quality on ecology has been assessed using a standard approach based on guidance provided by the EA. Using this approach, in relation to the Critical Level and Critical Loads set for the protection of ecology the following can be concluded from the assessment.

1. At all identified ecological receptors, there is predicted to be a slight decrease in impacts as a result of the proposed variation. This is attributed to the increase in velocity which offsets the increase in the release rate of pollutants.
2. The change in impact as a result of the EP variation can be screened out as 'insignificant' as it is less than 1% of the long term Critical Levels and Critical Loads and less than 10% of the short term Critical Levels
3. At all identified European and UK designated ecological receptors, the contribution of the Proposed Facility can be screened out as 'insignificant' as it is less than 1% of the long term Critical Levels and Critical Loads and less than 10% of the short term Critical Levels.
4. At all local ecological sites, the contribution from the Proposed Facility can be screened out 'insignificant' as it is less than 1% of the long term Critical Levels and Critical Loads and less than 10% of the short term Critical Levels.

Approach and Assessment of Impact of Odour

There are a number of other potential sources of odour on site. These are associated with the processes carried out within enclosed environments and an odour management plan is in place which includes measures to minimise the potential for any adverse odour impacts.

Of the sources of odour there are two-point sources; the extraction from the odour control system for the main building and the SBR tank. The dispersion model has been used to predicted impacts of these point sources on the local environment. This has shown that the maximum predicted 98^{th} percentile of 1-hour impacts is well below the benchmark criteria for most offensive odours set by the EA. Therefore, there are not expected to be any unacceptable impacts on odour in the local area from the odour control systems and SBR tank.

Summary and Conclusions

In summary, the assessment has shown that the change in air quality impact associated with the proposed EP variation would be 'insignificant'. In addition, the total impact of the Facility would not have a significant impact on local air quality, the general population or the local community. As such there should be no air quality constraint in granting a variation to the EP for the proposed changes.

Contents

1 Introduction

1.1 Background

Fichtner Consulting Engineers Ltd ("Fichtner") has been engaged by SUEZ Recycling and Recovery Surrey Ltd to undertake a Dispersion Modelling Assessment to support the application for a variation to the Environmental Permit (EP) for the Charlton Lane Eco Park (herein referred to as the Facility). Full details of the proposed changes being applied for can be found in the Supporting Information document.

This assessment has considered the following:

- the "Permitted Facility" – the model has been set up with data as set out in the most recent EP application documents and this has been used to evaluate the impact of the existing permitted Facility; and
- the "Proposed Facility" – using the dispersion model inputs based on the design as proposed as part of this variation. This has been used to evaluate the impact of the Facility as proposed.
- The difference in impact has been quantified to determine the impact of this variation application.

When considering the impact on human health, the predicted atmospheric concentrations have been compared to the Air Quality Assessment Levels (AQALs) for the protection of human health. It is noted that for dioxins the AQAL is a Tolerable Daily Intake (TDI) which considered the combination of the intake from inhalation and ingestion. As such it is not possible to demonstrate compliance with the assessment level with just reference to the air concentration. As such, a separate Dioxin Pathway Intake Assessment has been undertaken to assess the pathway intake of these pollutants and impacts compared to the TDI. This is provided as a separate technical report to support the EP application. Dioxins are only released from the gasification plant as such the Dioxin Pathway Intake Assessment only considers the impact of emissions from the gasification plant.

When considering the impact on ecosystems the predicted atmospheric concentrations have been compared to the Critical Levels for the protection of ecosystems. It is noted that deposition of emissions over a prolonged period can have nutrification and acidification impacts. An assessment of the long-term deposition of pollutants has been undertaken and the results compared to the habitat specific Critical Loads.

A separate abnormal emissions assessment has been produced to support the EP variation application which considers the impact of abnormal operations of the gasification plant as defined within the IED, this considers abnormal operation of the gasification plant and in combination with the other permitted sources on site.

1.2 Structure of the report

This report has the following structure.

- National and international air quality legislation and guidance are considered in section 2.
- The background levels of ambient air quality are described in section 3.
- The residential properties and ecological receptors which are sensitive to changes in air quality associated with the Facility and identified in section 4.
- The inputs used for the dispersion model are contained in section 5.

- Details of the sensitivity analysis carried out is presented in section 6.
- The assessment methodology and results of the assessment of the impact of emissions on human health is presented in section 7.
- The assessment methodology and results of the assessment of the impact of emissions at ecological sites is presented in section 8.
- The conclusions of the assessment are set out in section 9.
- The Appendices include illustrative figures and detailed results tables.

2 Legislation Framework and Policy

2.1 Air quality assessment levels

European air quality legislation is consolidated under the Ambient Air Quality Directive (Directive 2008/50/EC), which came into force on 11 June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides Ambient Air Directive (AAD) Limit Values for sulphur dioxide, nitrogen dioxide, benzene, carbon monoxide, lead and particulate matter with a diameter of less than 10 µm (PM_{10}) and a new AAD Target Value and Limit Value for fine particulates (those with a diameter of less than 2.5 µm ($PM_{2.5}$). The fourth daughter Directive - 2004/107/EC - was not included within the consolidation. It sets health-based Target Values for polycyclic aromatic hydrocarbons (PAHs), cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable. Directives 2008/50/EC and 2004/107/EC are transposed under UK Law into the Air Quality Standards Regulations (2010). The regulations also extend powers, under Section 85(5) of the Environment Act (1995), for the Secretary of State to give directions to local authorities for the implementation of these Directives.

The UK Government and the devolved administrations are required, under the Environment Act (1995), to produce a national air quality strategy. This was last reviewed and published in 2007. The Air Quality Strategy (AQS) sets out the UK's air quality objectives and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. This is the method of the implementation of the AADT Limits and Targets. This includes additional targets and limits for 15-minute sulphur dioxide and 1,3-butadiene and more stringent requirements for benzene and PAHs, known as AQS Objectives.

The Air Quality Strategy defines "standards" and "objectives" in paragraph 17:

"For the purposes of the strategy:

- *standards are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups or on ecosystems; and*
- *objectives are policy targets often expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale."*

The status of the objectives is clarified in paragraph 22, which also emphasises the importance of European Directives:

"The air quality objectives in the Air Quality Strategy are a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except in as far as these mirror any equivalent legally binding limit values in EU legislation. Where UK standards or objectives are the sole consideration, there is no legal obligation upon regulators, to set Emission Limit Values (ELVs) any more stringent than the emission levels associated with the use of Best Available Techniques (BAT) in issuing permits under the PPC Regulations. This aspect is dealt with fully in the PPC Practical Guides."

In 2019 the UK Government published the Clean Air Strategy (CAS). This sets out methods by which air pollution from all sectors will be reduced. The CAS has not introduced any new air quality limits. However, the CAS sets out the actions required across all parts of the government to meet legally binding targets to reduce five key pollutants (fine particulate matter, ammonia, nitrogen oxides, sulphur dioxide, non-methane volatile organic compounds) by 2020 and 2030 and secure health public health benefits. The CAS also makes a commitment to bring forward primary legislation on clean air as outlined in the Environmental Act.

The Environment Act introduces a duty on the government to set a legally binding target for $PM_{2.5}$s. To date this has not yet been set. The Department for the Environment Food and Rural Affairs (Defra) fact sheet sets out that:

"The government is committed to evidence-based policy making, and will consider the WHO's annual mean guideline level for $PM_{2.5}$ when setting the target, alongside independent expert advice, evidence and analysis on a diversity of factors – from the health benefits of reducing $PM_{2.5}$, to the practical feasibility and economic viability of taking different actions.

It would be irresponsible to set a target without giving consideration to its achievability and the measures required to deliver on that target.

The target level and achievement date will be developed during the target setting process and will follow in secondary legislation."

The WHO annual mean PM guideline values are as follows:

- Fine particulate matter ($PM_{2.5}$) – 10 µg/m^3 as an annual mean, and 25 µg/m^3 as a daily mean.
- Course particulate matter (PM_{10}) – 20 µg/m^3 as an annual mean, and 50 µg/m^3 as a daily mean.

For other pollutants the EA set Environmental Assessment Levels (EALs) in the environmental management guidance document 'Air Emissions Risk Assessment for your Environmental Permit' (Air Emissions Guidance). The long-term and short-term EALs from this document have been used when the AQS does not contain relevant objectives. Standards and objectives for the protection of sensitive ecosystems and habitats are also contained within the Air Emissions Guidance and the Air Pollution Information System (APIS).

AAD Target and Limit Values, AQS Objectives, and EALs are set at levels well below those at which significant adverse health effects have been observed in the general population and in particularly sensitive groups. For the remainder of this report these are collectively referred to as Air Quality Assessment Levels (AQALs). Table 1, Table 2 and Table 3 summarise the air quality objectives and guidelines used in this assessment.

Table 1: Air Quality Assessment Levels (AQALs)

Pollutant	Limit value (µg/m^3)	Averaging period	Frequency of exceedances	Source
Nitrogen dioxide	200	1 hour	18 times per year (99.79th percentile)	AQS Objective
	40	Annual	-	AQS Objective
Sulphur dioxide	266	15 minutes	35 times per year (99.9th percentile)	AQS Objective
	350	1 hour	24 times per year (99.73rd percentile)	AQS Objective
	125	24 hours	3 times per year (99.18th percentile)	AQS Objective
Particulate matter (PM_{10})	50	24 hours	35 times per year (90.41st percentile)	AQS Objective
	50	24 hours	-	WHO Guideline

Pollutant	Limit value (µg/m³)	Averaging period	Frequency of exceedances	Source
	40	Annual	-	AQS Objective
Particulate matter ($PM_{2.5}$)	25	Annual	-	AQS Target Value
	25	24 hours	-	WHO Guideline
	10	Annual	-	WHO Guideline
Carbon monoxide	10,000	8 hours, running	-	AQS Objective
	30,000	1 hour		Air Emissions Guidance
Hydrogen chloride	750	1 hour	-	Air Emissions Guidance
Hydrogen fluoride	160	1 hour	-	Air Emissions Guidance
	16	Annual	-	Air Emissions Guidance
Ammonia	2,500	1 hour	-	Air Emissions Guidance
	180	Annual	-	Air Emissions Guidance
Lead	0.25	Annual	-	AQS Objective
Benzene	5.00	Annual	-	AQS Objective
	30	24 hours	-	Air Emissions Guidance
1,3-butadiene	2.25	Annual, running	-	AQS Objective
PCBs	6	1-hour	-	Air Emissions Guidance
	0.2	Annual	-	Air Emissions Guidance
PAHs	0.00025	Annual	-	AQS Objective

As shown in Table 1, lead is the only metal included in the AQS. The AQS includes objectives to limit the annual mean to 0.5 µg/m³ by the end of 2004 and to 0.25 µg/m³ by the end of 2008. Only the first objective is included in the Air Quality Directive.

The fourth Daughter Directive on air quality (Commission Decision 2004/107/EC) includes target values for arsenic, cadmium and nickel. However, these values are the same as, or lower than, those included in the Air Emissions Guidance. Therefore, the Environmental Assessment Levels (EALs) from the Air Emissions Guidance shown in Table 2 have been used in this assessment.

Table 2: Environmental Assessment Levels (EALs) for Metals

Metal	Daughter Directive target level (µg/m³)	EALs (µg/m³)	
		Long-term	Short-term (*)
Arsenic	0.006	0.006	-
Antimony	-	5	150
Cadmium	0.005	0.005	-
Chromium (II & III)	-	5	150
Chromium (VI)	-	0.0002	-
Cobalt	-	-	-
Copper	-	10	200
Lead	-	0.25	-
Manganese	-	0.15	1500
Mercury	-	0.25	7.5
Nickel	0.020	0.020	-
Thallium	-	-	-
Vanadium	-	-	1,000
Note: **short term EAL is as a hourly mean with the exception of vanadium which is as a 24-hour mean*			

Table 3: Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	Concentration (µg/m³)	Measured as	Source
Nitrogen oxides (as nitrogen dioxide)	75 / 200*	Daily mean	Air Emissions Guidance
	30	Annual mean	AQS Objective
Sulphur dioxide	10	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystem's integrity	Air Emissions Guidance
	20	Annual mean for all higher plants	AQS Objective
Hydrogen fluoride	5	Daily mean	Air Emissions Guidance
	0.5	Weekly mean	Air Emissions Guidance

Pollutant	Concentration ($\mu g/m^3$)	Measured as	Source
Ammonia	1	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystem's integrity	Air Emissions Guidance
	3	Annual mean For all higher plants	Air Emissions Guidance
Notes: **only for detailed assessments where the ozone is below the AOT40 critical level and sulphur dioxide is below the lower critical level of 10 $\mu g/m^3$* The *AOT40 for ozone is 3,000 ppb.h (6,000 $\mu g/m^3$.h) calculated from accumulated hourly ozone concentrations – AOT40 means the sum of the difference between each hourly daytime (08:00 to 20:00 Central European Time, CET) ozone concentration greater than 80 $\mu g/m^3$ (40 ppb) and 80 $\mu g/m^3$, for the period between 01 May and 31 July.*			

In addition to the Critical Levels set out in Table 3, provides habitat specific Critical Loads for nitrogen and acid deposition. Full details of the habitat specific Critical Loads can be found in Appendix B.

2.2 Areas of relevant exposure

The AQALs apply only at areas of exposure relevant to the assessment level. The following table extracted from Local Authority Air Quality Technical Guidance (TG16) (2021) (LAQM.TG(16)) explains where the AQALs apply.

Table 4: Guidance on Where AQALs Apply

Averaging period	AQALs should apply at:	AQALs should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
24-hour mean and 8-hour mean	All locations where the annual mean AQAL would apply, together with	Kerbside sites (as opposed to locations at the building façade), or any other location where public

Averaging period	AQALs should apply at:	AQALs should generally not apply at:
	hotels. Gardens of residential properties.	exposure is expected to be short-term.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean AQALs apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-minute mean	All locations where members of the public might reasonably be exposed for a period of 15-minutes or longer.	

Source: Box 1.1 LAQM.TG(16)

2.3 Industrial pollution regulation

Atmospheric emissions from industrial processes are controlled in England through the Environmental Permitting Regulations (2012) (and subsequent amendments). The Facility currently has an EP to operate. The EP includes conditions to ensure that the environmental impact of the operations is minimised. This includes conditions to prevent fugitive emissions of dust and odour beyond the boundary of the permitted activity, and limits on emissions to air.

The Industrial Emissions Directive (IED) (Directive 2010/75/EU), was adopted on 07 January 2013, and is the key European Directive which covers almost all regulation of industrial processes in the European Union (EU). Within the IED, the requirements of the relevant sector BREF (Best Available Techniques Reference documents) become binding as BAT (Best Available Techniques) guidance, as follows.

- Article 15, paragraph 2, of the IED requires that ELVs are based on best available techniques, referred to as BAT.
- Article 13 of the IED, requires that 'the Commission' develops BAT guidance documents (referred to as BREFs).
- Article 21, paragraph 3, of the IED, requires that when updated BAT conclusions are published, the Competent Authority (in England this is the EA) has up to four years to revise permits for facilities covered by that activity to comply with the requirements of the sector specific BREF.

The EA explain that ‘BAT’ means the available techniques which are the best for preventing or minimising emissions and impacts on the environment where ‘techniques’ include both the technology used and the way the installation is designed, built, maintained, operated and decommissioned.

The Waste Incineration BREF (WI BREF) was published by the European Integrated Pollution Prevention and Control (IPPC) Bureau in December 2019. The WI BREF has introduced BAT-AELs (BAT-Associated Emission Levels) which are more stringent than those currently set out in the existing EP for some pollutants.

Whilst the WI BREF Review process for the Facility is ongoing, for the Proposed Facility it has been assumed that the emission limits within the EP for the gasification plant are at the upper-end of the BAT-AEL, with the exception of NOx which has been assumed to be at the existing ELV.

2.4 Local air quality management

In accordance with Section 82 of the Environment Act (1995) (Part IV), local authorities are required to periodically review and assess air quality within their area of jurisdiction, under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves assessing present and likely future ambient pollutant concentrations against AQALs. If it is predicted that levels at the façade of buildings where members of the public are regularly present (normally residential properties) are likely to be exceeded, then the local authority is required to declare an Air Quality Management Area (AQMA). For each AQMA, the local authority is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant levels in pursuit of the relevant AQALs.

3 Baseline Air Quality

The Facility is located off Charlton Lane, Shepperton within the Spelthorne Borough Council area of jurisdiction. The Facility is immediately to the east of the M3, with a mixture of fields and residential areas surrounding. The location of the Facility is shown in Figure 1 of Appendix A.

3.1 Air quality management areas

The site is located within the Spelthorne AQMA, which encompasses the whole borough, this has been declared due to concern over nitrogen dioxide concentrations which have been linked to road transport. The extents of the AQMA are displayed in Figure 2 of Appendix A.

The impact of emissions from the Facility upon the Spelthorne AQMA has been quantified within this assessment.

3.2 National modelling – mapped background data

In order to assist local authorities with their responsibilities under LAQM, Defra provides modelled background concentrations of pollutants throughout the UK on a 1 km by 1 km grid. This model is based on known pollution sources and background measurements and is used by local authorities in lieu of suitable monitoring data. In addition, mapped atmospheric concentrations of ammonia are available from APIS. Concentrations will vary over the modelling domain area. Therefore, the maximum mapped background concentration data within 3 km of the Facility have been downloaded along with the concentrations for the grid squares containing the Facility. A summary is presented in Table 5.

Table 5: Mapped Background Data

Pollutant	Annual mean concentration (µg/m³)		Dataset
	At Facility	Max within 3 km of Facility	
Nitrogen dioxide	18.92	22.39	2018 Defra dataset
Sulphur dioxide	4.39	8.54	2001 Defra dataset
Particulate matter (as PM_{10})	16.04	17.37	2018 Defra dataset
Particulate matter (as $PM_{2.5}$)	11.06	12.20	2018 Defra dataset
Carbon monoxide	467	472	2001 Defra dataset
Benzene	0.90	0.91	2001 Defra dataset
1,3-butadiene	0.40	0.41	2001 Defra dataset
Ammonia	1.8	1.8	APIS mid year 3 year average 2018 to 2020

Source: © Crown 2022 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).

3.3 Site specific monitoring

SUEZ carry out monitoring using a continuous analyser at a location along Haslett Road, approximately 730 m to the north-east of the Facility as shown on Figure 2 of Appendix A.

This site is classified as a “background” site. Background sites are positioned so that they are not influenced significantly by any single source or street but rather by the integrate contribution from all sources upwind of the station and are considered broadly representative for several square kilometres. Whereas roadside sites are predominately determined by emissions from nearby traffic and are only representative of air quality for the immediate area of the analyser. Therefore, monitoring from this site is directly representative of conditions around the point of maximum impact of emissions.

The monitoring started in March 2016. At this site concentrations of nitrogen dioxide and particulate matter (as PM_{10} and $PM_{2.5}$) are monitored. A summary of the monitoring data over the last 5 full years is provided in Table 6.

Table 6: Haslett Road Analyser

Averaging period	AQAL	Annual mean concentration (µg/m³)				
		2017	2018	2019	2020	2021
Nitrogen dioxide						
Annual mean	40	24.0	21.6	17.1	17.6	15.2
97.79th %ile of 1-hour means	200	136.7	91.9	90.6	83.0	70.5
Particulate matter (as PM_{10})						
Annual mean	40	20.7	19.5	24.6	20.7	19.2
90.41st %ile of 24-hour means	50	35.5	31.4	36.6	34.3	30.3
Particulate matter (as $PM_{2.5}$)						
Annual mean	20	13.3	12.4	12.9	12.2	11.0

Source: Annual monitoring report 2021 - Fichtner

The commissioning of the gasification plant began in September 2019, and the anaerobic digestion plant in May 2019. Therefore, since this date there has been a contribution from the Facility within the monitored concentration. As shown, monitored concentrations are well below the AQAL. A detailed discussion of the monitoring data with reference to wind speed and direction, and diurnal profiles, is carried out each year and presented in the annual monitoring report. This shows that the main source of emissions at this monitoring site is likely to be the local road network, rather than any measurable contribution from the Facility.

The Defra mapped background concentration for 2018 at this site was:

- Nitrogen dioxide = 21.8 µg/m^3
- Particulate matter as PM_{10} = 16.9 µg/m^3
- Particulate matter as $PM_{2.5}$ = 11.8 µg/m^3

This is broadly similar to the monitored concentration suggesting that the mapped background model is performing well in the local area and representative of actual background concentrations.

3.4 AURN monitoring data

The UK Automatic Urban and Rural Network (AURN) is a country-wide network of air quality monitoring stations operated on behalf of the Defra. This includes automatic monitoring of oxides of nitrogen, nitrogen dioxide, sulphur dioxide, ozone, carbon monoxide and particulates.

The closest AURN monitoring station to the Facility is London Teddington Bushy Park, an urban background site 7 km to the east of the Facility. Given the local monitoring at Haslett Road it is not considered necessary to analyse this data.

3.5 LAQN and LAQM monitoring data

In addition to the national AURN, local authorities undertake monitoring of a range of pollutants as part of the LAQM review process and London has its own LAQN. A review of the monitoring undertaken by Spelthorne Borough Council has shown that it currently reports from the following continuous analysers:

- Oaks Road – an urban background site located 6.5 to the north-west of the Facility;
- Sunbury Cross – an urban background site located 2.2 km to the north-east of the Facility;
- Haslett Road – the urban background site discussed in section 3.3.

In addition to the continuous analysers Spelthorne Borough Council undertakes monitoring of nitrogen dioxide using diffusion tubes. This includes monitoring at 19 locations within 3 km of the Facility. This includes monitoring at 4 urban background sites, 9 roadside, and 6 kerbside sites. The location of these diffusion tubes and the continuous analysers is shown on Figure 2 of Appendix A. All sites are located within the AQMA which has been declared due to concern over annual mean nitrogen dioxide concentrations.

Table 7 provides a summary of the annual mean nitrogen dioxide monitoring at each of the sites within 3 km of the Facility.

Table 7: Summary of Nitrogen Dioxide Monitoring Results

Site ID	Site name	Annual mean concentration (µg/m^3)				
		2017	2018	2019	2020	2021
Urban background sites						
SP6	Goffs Road, Ashford Common	24.3	22.4	25.2	17.8	18.6
SP23	Greeno Crescent, Shepperton	23.2	23.9	25.9	16.6	17.0
SP43, SP44, SP45	The Haven, Sunbury	32.9	30.8	33.4	22.7	22.4
SP56	Shepherds Close	21.2	21.7	23.0	14.9	16.0
SUN	Sunbury Cross	32.5	32.5	33.1	23.0	22.9
SCC	Haslett Road	24.0	21.6	17.1	17.6	15.2
Roadside sites						
SP4	Benwell Centre, Sunbury	26.6	24.9	26.3	19.5	20.9
SP10	Walton Bridge Road	35.1	35.1	37.4	24.5	28.7
SP34	School Road, Ashford	37.8	35.2	38.6	23.9	29.1
SP35	Vicarage Road, Sunbury	37.0	36.7	**41.6**	27.4	27.3
SP36	St Ignatius School, Sunbury	**40.2**	34.7	34.6	24.4	26.7
SP50	Waterside Close, Shepperton	32.9	35.4	37.4	24.6	25.1
SP52	Staines Road East, Sunbury	32.3	32.7	37.3	24.1	24.5
SP59	High Street, Shepperton (Village Hall)	-	-	27.9	20.4	20.5
SP66	Springfields School, Nursery Road,	-	-	-	-	20.0

Site ID	Site name	Annual mean concentration (µg/m³)				
		2017	2018	2019	2020	2021
Kerbside sites						
SP9	Staines Road West, Sunbury	**41.7**	39.0	**40.8**	26.9	28.8
SP11	Halliford Bypass	35.4	29.8	34.0	23.6	25.4
SP41	Green Street, Sunbury	30.0	28.2	29.6	20.7	21.4
SP54	Russell Road, Shepperton	29.0	32.1	31.0	20.0	21.4
SP55	Green Lane, Shepperton	32.9	34.2	38.8	25.2	25.9
SP58	Sunbury Cross (east)	-	-	**51.1**	35.8	35.1

Source: Spelthorne Borough Council LAQM Annual Status Report 2022

In addition to nitrogen dioxide monitoring using diffusion tubes undertaken by Spelthorne Borough Council it also undertakes monitoring of particulate matter using continuous analysers.

Table 8 provides a summary of the annual mean particulate matter monitoring at each of the sites within 3 km of the Facility.

Table 8: Summary of PM Monitoring Results

Site ID	Site name	Annual mean concentration (µg/m³)				
		2017	2018	2019	2020	2021
Particulate matter (as PM_{10})						
SUN	Sunbury Cross	13.1	14.5	15.7	14.2	13.2
SCC	Haslett Road	20.7	19.5	24.6	20.7	19.2
Particulate matter (as $PM_{2.5}$)						
SUN	Sunbury Cross	8.0	9.2	9.9	8.3	8.1
SCC	Haslett Road	13.3	12.4	12.9	12.2	11.0

Where exceedances of the nitrogen dioxide annual mean AQAL have been recorded these are all located at roadside and kerbside sites within the AQMA.

Concentrations of nitrogen dioxide and particulate will vary spatially, but a large contributor is road traffic emissions. For the initial screening, the baseline concentration has been assumed to be the maximum monitored concentration from the Haslett Road site over the period of 2017 to 2021 as this is located in the area where the peak impacts are predicted to occur. Where further consideration of the baseline concentration is needed, additional consideration will be made to the choice of baseline concentration taking into account the spatial variability of these emissions.

3.6 Other national monitoring networks data

Neither the Defra mapped background dataset, AURN, LAQM or LAQN include monitoring of other pollutants released from the Facility such as hydrogen chloride, hydrogen fluoride, VOCs, metals or dioxins. As such reference has been made to national modelling to determine a suitable baseline concentration.

3.6.1 Hydrogen chloride

Hydrogen chloride was measured until the end of 2015 on behalf of Defra as part of the UK Eutrophying and Acidifying Atmospheric Pollutants (UKEAP) project. This consolidates the previous Acid Deposition Monitoring Network (ADMN), and National Ammonia Monitoring Network (NAMN). Monitoring of hydrogen chloride ceased at the end of 2015 and none of the historic sites were located within 10 km of the Facility. Prior to the cessation of the monitoring concentrations were fairly constant.

The maximum annual average monitored within the UK between 2011 and 2015 was 0.71 µg/m^3. There are no other local significant sources of hydrogen chloride, therefore, in lieu of any recent representative monitoring this has been used as the baseline concentration for this assessment as a conservative estimate.

3.6.2 Hydrogen fluoride

Baseline concentrations of hydrogen fluoride are neither measured locally nor nationally, since these are not generally of concern in terms of local air quality. However, the EPAQS report ‘Guidelines for halogens and hydrogen halides in ambient air for protecting human health against acute irritancy effects’ contains some estimates of baseline levels, reporting that measured concentrations have been in the range of 0.036 µg/m^3 to 2.35 µg/m^3.

There are no other local significant sources of hydrogen fluoride, therefore, in lieu of any local monitoring, the maximum measured baseline hydrogen fluoride concentration has conservatively been used as the baseline concentration for this assessment.

3.6.3 Ammonia

Ammonia is also measured as part of the UKEAP project at rural background locations, and London Cromwell Road. There are no UKEAP monitoring locations within 10 km of the Facility. The nearest monitoring site is London Cromwell Road, 21 km to the north-east. In lieu of any local UKEAP monitoring, the maximum mapped background value from APIS for the grid square containing the Facility has been used for the purpose of this assessment (1.8 µg/m^3) when considering the impact with reference to the AQALs for the protection of human health, and the maximum concentration across the designated site from the APIS has been used when evaluating the impact at ecological receptors.

3.6.4 Volatile Organic Compounds

As part of the Automatic and Non-Automatic Hydrocarbon Network, benzene concentrations are measured at sites co-located with the AURN across the UK. In 2007, due to low monitored concentrations of 1,3-butadiene at non-automatic sites, Defra took the decision to cease non-automatic monitoring of 1,3-butadiene. The closest monitoring site to the Facility is London Marylebone Road, an automatic monitoring site 24 km to the north-east. This site is not considered to be representative of general conditions close to the Facility as this monitor is located adjacent to a busy road within central London. As there are no representative monitors in the locality of the Facility, the maximum mapped background values for the grid square within 3km of the Facility, 0.91 µg/m^3 and 0.41 µg/m^3 respectively, has been used as the baseline concentration as shown in Table 5.

3.6.5 Metals

Metals are measured as part of the Rural Metals and UK Urban/Industrial Networks (previously the Lead, Multi-Element and Industrial Metals Networks). The closest metals monitoring site is located at London Marylebone Road, an urban traffic site 24 km to the north-east. This site is not considered to be representative of general conditions close to the Facility as this monitor is located adjacent to a busy road within central London. There are no other local significant sources of metals, therefore, the maximum from all 'urban background' site across the UK has been used as the baseline concentration for the purpose of this assessment.

Table 9: Annual Mean Metals Concentrations – Maximum any urban-background site

Substance	Annual mean concentration (ng/m³)						Max (as % of AQAL)
	AQAL	2017	2018	2019	2020	2021	
Cadmium	5	0.49	0.43	0.35	0.42	0.35	4.4%
Thallium	-	-	-	-	-	-	-
Mercury	250	2.70	2.80	-	-	-	1.1%
Antimony	5,000	-	-	-	-	-	-
Arsenic	6	1.10	1.00	1.00	1.00	0.98	13.3%
Chromium	5,000	34.00	39.00	25.00	21.00	33.00	0.17%
Cobalt	-	0.84	0.92	0.56	0.84	0.65	-
Copper	10,000	20.00	26.00	22.00	18.00	16.00	0.11%
Lead	250	16.00	20.00	13.00	12.00	22.00	4.4%
Manganese	150	35.00	36.00	26.00	23.00	35.00	6.8%
Nickel	20	17.00	20.00	15.00	11.00	14.00	27.7%
Vanadium	-	1.30	1.70	1.50	3.00	3.00	0.02%
Notes: *Data for mercury from London Westminster*							

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In addition to the suite of metals monitored at urban background sites there would be releases of thallium, mercury and antimony from the Facility. With reference to these pollutants:

- Thallium is not routinely monitored as part of the metals network, nor is there an AQAL for the protection of human health. This assessment has considered the total impact of cadmium and thallium and has used the cadmium baseline concentration and AQAL.
- Monitoring of mercury ceased in August 2018 and from 2016 this was only carried out at two sites across the UK - London Westminster and Runcorn Western Point. Concentrations at both sites were significantly below the AQAL. For the purpose of this assessment the maximum concentration from London Westminster has been used as the baseline concentration.
- Monitoring of antimony across the UK ceased at the end of 2013. The maximum monitored at any background site in 2013 was 1.30 ng/m³ at Detling, which has been used as the baseline concentration for the assessment. This value is only 0.026% of the annual mean AQAL of 5,000 ng/m³.

As a conservative assumption the maximum monitored concentrations for each metal at urban backgrounds sites across the UK as presented in Table 9 has been used as the baseline concentration within this assessment, with the baseline concentration of antimony from Detling.

3.6.6 Dioxins, furans and polychlorinated biphenyl (PCBs)

Dioxins, furans and PBCs are monitored on a quarterly basis at a number of urban and rural stations in the UK as part of the Toxic Organic Micro Pollutants (TOMPs) network. There are no monitoring locations within 10 km of the Facility. The closest monitoring site is located at London Nobel House, approximately 24 km to the north-east of the Facility.

A summary of dioxin and furan and PCB concentrations from all monitoring sites across the UK is presented in Table 10 and Table 11. Note that monitoring data for dioxins and furans is only available up to the end of 2016 from the UK-Air website. For PCBs, data is only available up to the end of 2018 from the UK-Air website.

Table 10: Dioxin and Furans Monitoring

Site	Annual mean concentration (fgTEQ/m³)				
	2012	2013	2014	2015	2016
Auchencorth Moss	0.13	0.86	0.01	0.01	0.13
Hazelrigg	8.75	2.02	2.61	5.27	4.59
High Muffles	4.32	0.6	1.07	0.54	2.73
London Nobel House	15.42	3.47	2.89	4.34	21.27
Manchester Law Courts	32.99	10.19	16.52	5.94	12.23
Weybourne	9.3	2.34	1.61	1.42	16.32

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Table 11: PCB Monitoring

Site	Annual mean concentration (pg/m³)				
	2014	2015	2016	2017	2018
Auchencorth Moss	23.23	24.27	25.32	19.09	12.31
Hazelrigg	25.84	41.68	52.58	33.15	22.22
High Muffles	26.11	33.43	37.76	31.63	8.86
London Nobel House	107.49	121.39	110.46	121.87	46.63
Manchester Law Courts	128.93	97.99	92.6	97.27	40.10
Weybourne	17.00	20.95	38.61	32.26	11.23

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As shown, the concentrations vary significantly between sites and years. As there are no monitoring sites located within close proximity of the Facility, or any mapped background datasets, the maximum monitored concentration from the past 5 years of available monitoring data has been used as the baseline concentration within this assessment. These values are 32.99 fg/TEQ/m³ for dioxins and furans and 128.93 pg/m³ for PCBs.

3.6.7 Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic Aromatic Hydrocarbons (PAHs) are monitored at a number of stations in the UK as part of the PAH network. For the purpose of this assessment, benzo(a)pyrene is considered as this is the only PAH which an AQAL has been set. There are no PAH analysers within 10 km of the Facility with the closest monitoring station located at London Brent, an urban background site 24 km to the north-east.

A summary of benzo(a)pyrene concentrations from all urban background sites in the UK is presented in Table 12, together with concentrations from the other sites in London.

Table 12: Benzo(a)pyrene

Site Type	Quantity	AQAL (ng/m³)	Annual mean concentration (ng/m³)				
			2017	2018	2019	2020	2021
All urban background sites	Min	0.25	0.08	0.05	0.06	0.06	0.04
	Max		**1.30**	**0.86**	**0.74**	**0.83**	**0.55**
	Average		0.33	0.24	0.21	0.26	0.19
London Marylebone Road		0.25	0.16	0.12	0.13	0.10	0.13
London Brent		0.25	0.16	0.12	0.15	0.11	0.11

Source: © Crown 2022 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).

As shown the maximum monitored concentration at an urban background site exceeds the AQAL of 0.25 ng/m³. However, at both the London sites (roadside and background site) the monitored concentration is well within the below the AQAL. The AQAL goes beyond the requirement of the European Directive (Commission Decision 2004/107/EC) which sets a target value of 1 ng/m³, which is not exceeded at any urban background site. In lieu of any local monitoring of PAHs or any mapped background datasets, the maximum concentration from any London site has been used as the baseline concentration (0.16 ng/m³ – 2017).

3.7 Summary

In summary, a continuous analyser has been installed to the north-east of the Facility, in the area of residential properties. This has shown that baseline concentrations of nitrogen dioxide and particulate matter away from the roads is similar to the Defra mapped background concentration. Suggesting that the mapped background model is performing well in the local area and can be used as a source of baseline concentrations at background locations.

The concentrations of road traffic pollutants (nitrogen dioxide and particulate matter) vary spatially across the modelling domain. As such for these pollutants additional consideration will be given to determine the baseline concentration for these pollutants taking into account the local monitoring data.

For other pollutants, in the first instance, it will be assumed that baseline concentrations are as per those set out in Table 13. These are based on a mixture of monitoring at modelled data sets. Where the contribution from the Facility cannot be screened out as 'insignificant' (refer to section 7.1 for the methodology), the choice of baseline concentration will be given additional consideration.

Table 13: Summary of Baseline Concentrations

Pollutant	Annual mean concentration	Units	Justification
Nitrogen dioxide	24.0	µg/m³	Maximum monitored concentration from the Haslett Road monitoring site (2017 to 2020)
Sulphur dioxide	8.54	µg/m³	Maximum mapped background concentration within 3km of the Facility (2001 Defra dataset)
Particulate matter (as PM_{10})	24.6	µg/m³	Maximum monitored concentration from the Haslett Road monitoring site (2017 to 2020)
Particulate matter (as $PM_{2.5}$)	13.3	µg/m³	
Carbon monoxide	472	µg/m³	Maximum mapped background concentration within 3km of the Facility (2001 Defra dataset)
Hydrogen chloride	0.71	µg/m³	Maximum monitored concentration across the UK 2011 to 2015
Hydrogen fluoride	2.35	µg/m³	Maximum measured concentration from EPAQS report
Ammonia	1.8	µg/m³	Mapped background concentration from APIS 2018 to 2020 3-year average
Benzene	0.91	µg/m³	Maximum mapped background concentration within 3km of the Facility (2001 Defra dataset)
1,3-butadiene	0.41	µg/m³	
Mercury	2.8	ng/m³	Maximum monitored concentration between 2017 and 2021 from London Westminster
Cadmium	0.14	ng/m³	Maximum UK monitored concentration between 2017 and 2021 at any urban background site, chromium VI assumed to be 20% of total chromium in line with EA's metal guidance[1].
Arsenic	0.94	ng/m³	
Chromium	3.00	ng/m³	
Chromium VI	0.60	ng/m³	
Cobalt	0.12	ng/m³	
Copper	16.00	ng/m³	
Lead	7.90	ng/m³	
Manganese	6.70	ng/m³	
Nickel	0.94	ng/m³	
Vanadium	1.10	ng/m³	
Antimony	1.30	ng/m³	The maximum monitored at any background site from the last year this was monitored (2013)

[1] Insert ref to EA metals guidance.

Pollutant	Annual mean concentration	Units	Justification
Dioxins and furans	32.99	fg/m^3	Maximum UK monitored concentration between 2012 and 2016
Polychlorinated biphenyl (PCBs)	128.93	pg/m^3	Maximum UK monitored concentration between 2014 and 2018
Benzo(a)pyrene (PAHs)	0.16	ng/m^3	Maximum monitored 2017 to 2021 at any site in London.

4 Sensitive Receptors

4.1 Human sensitive receptors

The general approach to the assessment is to evaluate the highest predicted process contribution to ground level concentrations. In addition, the predicted process contribution at a number of sensitive receptors has been evaluated. These sensitive receptors are displayed in Figure 3 of Appendix A and listed in Table 14. These are the same receptors used in the dispersion modelling carried out to support previous EP variations for the Facility.

Table 14: Sensitive Receptors

ID	Receptor name	Location		Distance from the stack (km)
		X (m)	Y (m)	
R1	Charlton Road South	508091	168086	0.68
R2	Nutty Lane	508155	168575	0.34
R3	Charlton Road North	508264	168770	0.25
R4	Hetherington Road	508483	169179	0.53
R5	Hawthorn Way North	508807	168458	0.37
R6	Hawthorn Way South	508749	168289	0.45
R7	Watersplash Road	507453	168557	1.03
R8	Birch Grove	509019	169047	0.67
Note: All modelled at 1.5m height				

In addition to the specific receptors identified above, consideration has been made to the distribution of emission using plot files if the process contribution at the point of maximum impact cannot be screened out as ‘insignificant’. It is noted that there is a footpath and access to land towards the northern boundary of the site. As such additional consideration has been made to the impact in this area using plot files which show the distribution of emissions.

4.2 Ecological sensitive receptors

A study was undertaken to identify the following sites of ecological importance in accordance with Air Emissions Guidance criteria:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), or Ramsar sites within 10 km of the Facility;
- Sites of Special Scientific Interest (SSSIs) within 2 km of the Facility; and
- National Nature Reserves (NNR), Local Nature Reserves (LNRs), Local Wildlife Sites and ancient woodlands within 2 km of the Facility.

These align with the sites identified by the EA in the Conservation Screening Report reference EPR/VP3997NK/V0008 dated 21 October 2022.

The sensitive ecological receptors identified are presented by distance from the stack in Table 15 and are displayed in Figure 4 and Figure 5 of Appendix A. A review of the citation for each site has been undertaken to determine if lichens are an important part of the ecosystem's integrity for the purposes of determining the relevant Critical Level for the habitat.

Table 15: Sensitive Ecological Receptors

ID	Name	Location		Distance from stack at closest point (km)
		X (m)	Y (m)	
European and UK designated sites				
E1	South-west London Waterbodies SPA and Ramsar (1)	511427	167907	3.0
E2	Thames Basin Heaths SPA	506987	159152	9.6
E3	Thursley, Ash, Pribright and Chobham SAC(2)	499351	164490	10.0
E4	Ash Link LNR	508072	168362	0.5
E5	Desborough Island LWS	507910	166560	2.2
E6	Littleton Lake LWS	506830	167890	1.8
E7	Ferris Meadows LWS	507700	166530	2.3
E8	Charlton Quarry LWS	507130	167285	1.9
E9	Sunbury Park LWS	510375	168790	1.9
E10	Queen Mary Reservoir LWS	507970	168915	0.6
E11	Littleton Lake – Shepperton Green Reservoir LWS	507040	167590	1.8
E12	Ashford Plant LWS	508668	169062	0.5
E13	River Ash: Shepperton Green LWS	508060	168420	0.5
E14	River Ash: Splash Meadow LWS	508135	168290	0.5
E15	River Ash: Gaston Bridge to Watersplash Farm LWS	509090	167780	1.1
E16	River Ash: Splash Meadow to Gaston Bridge LWS	508480	167820	0.8
E17	River Thames – Elmbridge LWS	510130	167710	1.9
E18	River Thames – Spelthorne LWS	508540	166060	2.6

Notes:

(1) South-west London Waterbodies SPA and Ramsar is made up of a number of discrete waterbodies, a point at the closest point to the Facility of each waterbody within 10 km of the Facility has been used. The point listed above is the closest point. the impacts are presented as the maximum at of the points used unless specified.

(2) identified within APIS that sensitive lichens or bryophytes may be present.

5 Modelling Methodology

5.1 Selection of model

Detailed dispersion modelling was undertaking using the model ADMS 5.2, developed and supplied by Cambridge Environmental Research Consultants (CERC) This is a new generation dispersion model, which characterises the atmospheric boundary layer in terms of the atmospheric stability and the boundary layer height. In addition, the model uses a skewed Gaussian distribution for dispersion under convective conditions, to take into account the skewed nature of turbulence. The model also includes modules to take account of the effect of buildings and complex terrain.

ADMS is routinely used for modelling of emissions for environmental permitting purposes to the satisfaction of the EA. An analysis of the variation in model outputs has been undertaken and the maximum predicted concentration for each pollutant and averaging period has been used to determine the significance of any potential impacts.

5.2 Source and emissions data – gasification plant

The source and emissions input data utilised within the modelling are presented in Table 16 to Table 19. The details of the "Permitted" scenario are taken from the Air Quality Assessment[2] submitted in support of the 2013 EP variation which was based on design data for the gasification plant. Details for the "Proposed" scenario have been calculated from the operational facility (as set out in the February 2022 compliance report[3]) with the proposed increase in the speed of the ID fan of 20% which equates to the proposed increase in capacity of the gasifier from 55,460 to 61,320 tonnes per annum (tpa).

Table 16: Source Data – Gasification Plant

Item	Unit	Permitted	Proposed
Stack data			
Height	m	49	
Internal diameter	m	1.2	1.17
Stack location	m, m	508482.92, 168645.14	
Flue gas conditions			
Temperature	°C	138	167.1
Pressure	kPa	101.1	101.1
Exit moisture content	% v/v	16.8	18.44
	kg/kg	0.121	0.136
Exit oxygen content	% v/v dry	11.8	10.2
Reference oxygen content	% v/v dry	11	11
Volume at reference conditions (273.15K, dry, ref O_2)	Nm^3/h	33,407	40,151
	Nm^3/s	9.28	11.15

[2] S1253-0120-0002RSS Air Quality Assessment 2013_Issue4_FINAL dated 19 October 2013

[3] Stack Emissions Testing Report, job reference EMT02649, dates of monitoring 16th to 17th February 2022.

Item	Unit	Permitted	Proposed
Volume at actual conditions	Am^3/h	65,723	73,440
	Am^3/s	18.26	20.4
Flue gas exit velocity	m/s	16.98	18.9
Notes: *Data for Proposed scenario taken from Socotec February 2022 compliance report and the actual volumetric flow rate increased by 20%.*			

The current EP (Ref: EPR/VP3997NK) includes emission limits for emissions to air for the gasification plant from the Industrial Emissions Directive (IED) (Directive 2010/75/EU) for the combustion of waste with the exception of NOx for which a lower ELV has been applied. This includes limits on emissions of oxides of nitrogen, sulphur dioxide, heavy metals and dioxins and furans, as well as other substances. The WI BREF introduces a requirement for compliance with the BAT Associated Emission Limits (AELs) which are more stringent than the ELVs set in the existing EP. The modelling has been carried out assuming the gasification plant as permitted operates at the ELVs in the existing EP. However, for the Proposed Facility scenario it is assumed that the gasification plant operates at the upper end of the BAT-AELs ranges for an existing waste incineration plant.

Table 17: Stack Emissions Data - Daily or Periodic ELV – Gasification Plant - Permitted

Pollutant	Daily or Periodic	Permitted
	Conc. (mg/Nm^3, unless stated)	Release rate (g/s, unless stated)
Oxides of nitrogen (as NO_2)	100	0.928
Sulphur dioxide	50	0.464
Carbon monoxide[(1)]	50	0.464
Total dust (PM)[(2)]	10	0.093
Hydrogen chloride	10	0.093
Volatile organic compounds (as TOC)	10	0.093
Hydrogen fluoride	2	0.019
Ammonia	10	0.093
Cadmium and thallium	0.05	0.464 mg/s
Mercury	0.05	0.464 mg/s
Other metals[(3)]	0.5	4.640 mg/s
Benzo(a)pyrene (PAHs)[(4)]	0.2 $\mu g/Nm^3$	1.856 µg/s
Dioxins and furans	0.1 $ngTEQ/Nm^3$	0.928 ng/s
PCBs[(5)]	5 $\mu g/Nm^3$	0.046 mg/s
Notes: *All emissions are expressed at reference conditions of dry gas, 11% oxygen, 273.15K.* *(1) Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24-hour period.*		

Pollutant	Daily or Periodic Conc. (mg/Nm³, unless stated)	Permitted Release rate (g/s, unless stated)
[2] As a worst-case it has been assumed that the entire dust emissions consist of either PM_{10} or $PM_{2.5}$ for comparison with the relevant AQALs.		
[3] Other metals consist of antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni) and vanadium (V).		
[4] The maximum monitored total PAH concentration from the existing facility during 2022 was <0.62 µg/m³, the average over the 3 monitoring reports was 0.33 µg/m³. The maximum recorded has been assumed to be the emission concentration for the Facility noting that this is conservative on a long term basis.		
[5] Table 3.8 of the 2006 WI BREF states that the annual average total PCBs is less than 0.005 mg/Nm³ (dry, 11% oxygen, 273K). Monitoring from the existing facility in 2022 showed that the maximum was 0.73 ng/Nm³ which is 0.01% of that presented in the WI BREF. As a conservative measure the annual average total PCBs concentration from the WI BREF has been assumed to be the emission concentration for the Facility.		

Table 18: Stack Emissions Data - Daily or Periodic ELV – Gasification Plant - Proposed

Pollutant	Daily or Periodic Conc. (mg/Nm³, unless stated)	Permitted Release rate (g/s, unless stated)
Oxides of nitrogen (as NO_2)	100	1.115
Sulphur dioxide	40	0.446
Carbon monoxide[1]	50	0.558
Total dust (PM)[2]	5	0.056
Hydrogen chloride	8	0.089
Volatile organic compounds (as TOC)	10	0.112
Hydrogen fluoride	2	0.022
Ammonia	10	0.112
Cadmium and thallium	0.02	0.223 mg/s
Mercury	0.02	0.223 mg/s
Other metals[3]	0.3	3.346 mg/s
Benzo(a)pyrene (PAHs)[4]	0.2 µg/Nm³	2.231 µg/s
Dioxins and furans	0.1 ngTEQ/Nm³	0.892 ng/s
PCBs[5]	5 µg/Nm³	0.056 mg/s
Notes:		
All emissions are expressed at reference conditions of dry gas, 11% oxygen, 273.15K.		
[1] Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24-hour period.		
[2] As a worst-case it has been assumed that the entire dust emissions consist of either PM_{10} or $PM_{2.5}$ for comparison with the relevant AQALs.		

Pollutant	Daily or Periodic	Permitted
	Conc. (mg/Nm³, unless stated)	Release rate (g/s, unless stated)
(3) Other metals consist of antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni) and vanadium (V).		
(4) The maximum monitored total PAH concentration from the existing facility during 2022 was <0.62 µg/m³, the average over the 3 monitoring reports was 0.33 µg/m³. The maximum recorded has been assumed to be the emission concentration for the Facility noting that this is conservative on a long term basis.		
(5) Table 3.8 of the 2006 WI BREF states that the annual average total PCBs is less than 0.005 mg/Nm³ (dry, 11% oxygen, 273K). Monitoring from the existing facility in 2022 showed that the maximum was 0.73 ng/Nm³ which is 0.01% of that presented in the WI BREF. As a conservative measure the annual average total PCBs concentration from the WI BREF has been assumed to be the emission concentration for the Facility.		

Although the WI BREF introduces more stringent daily mean BAT AELs there have been no changes to the short term ELVs as set out in the IED which are also set in the existing EP. The modelling has been carried out assuming the gasification plant as permitted and proposed operates at the ELVs in the existing EP

Table 19: Stack Emissions Data - Short Term

Pollutant	Half-hourly ELV	Permitted	Proposed
	Conc. (mg/Nm³)	Release Rate (g/s)	
Oxides of nitrogen (as NO_2)	400	3.712	4.461
Sulphur dioxide	200	1.856	2.231
Carbon monoxide(1)	150	1.392	1.673
Total dust (PM)(2)	30	0.278	0.335
Hydrogen chloride	60	0.557	0.669
Volatile organic compounds (as TOC)	20	0.186	0.223
Hydrogen fluoride (3)	4	0.037	0.045

Notes:

All emissions are expressed at reference conditions of dry gas, 11% oxygen, 273.15K.

(1) Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24-hour period.

(2) As a worst-case it has been assumed that the entire dust emissions consist of PM_{10} for comparison with the relevant short term AQAL.

(3) the Existing EP does not include a half-hourly ELV for hydrogen fluoride. As a conservative measure this has been included and assumed to be as per the IED.

As shown, the increase in throughput would result in the volumetric flow rate to be higher. This would result in a greater quantity of pollutants released on a g/s basis. However, this is accompanied by a higher flue gas exit velocity which will aid dispersion.

5.3 Source and emissions data – biogas engines

The source and emissions input data utilised within the modelling for the biogas engines are presented in Table 20 and Table 21. All data for the biogas engines for the Proposed scenario have been provided by the technology provider based on the detailed design calculations for the biogas engines installed (i.e. 2 engines with a thermal input of 2.87 MWth). The details of the "Permitted" biogas engines are taken from the Air Quality Assessment[4] submitted in support of the 2013 EP application which was based on design data for the anaerobic digestion facility at the time of application.

Table 20: Source Data – Biogas engines

Item	Unit	Permitted	Proposed
Stack data			
Height	m	49	
Internal diameter	m	0.347	
Stack location	m, m	508481.83, 168646.18 508483.92, 168464.18	
Flue gas conditions			
Temperature	°C	250	422
Exit moisture content	% v/v	9.0	11.8
	kg/kg	0.059	0.080
Exit oxygen content	% v/v dry	9.0	9.4
Reference oxygen content	% v/v dry	5.0	5
Volume at reference conditions (273.15K, dry, ref O_2)	Nm^3/h	3,427	3,262
	Nm^3/s	0.95	0.91
Volume at actual conditions	Am^3/h	7,213	12,963
	Am^3/s	2.00	3.60
Flue gas exit velocity	m/s	21.19	38.08

Table 21: Stack Emissions Data - Periodic ELV – Biogas engines

Pollutant	Daily or Periodic	Permitted	Proposed
	Conc. (mg/Nm^3)	Release rate (g/s)	
Oxides of nitrogen (as NO_2)	300	0.286	0.272
Sulphur dioxide	350	0.333	0.317
Carbon monoxide	1,400	1.333	1.269
Volatile organic compounds (as TOC)	1,000	0.952	0.906
Notes:			

[4] S1253-0120-0002RSS Air Quality Assessment 2013_Issue4_FINAL dated 19 October 2013

Pollutant	Daily or Periodic	Permitted	Proposed
	Conc. (mg/Nm³)	Release rate (g/s)	
All emissions are expressed at reference conditions of dry gas, 5% oxygen, 273.15K.			

As shown, there is predicted to be slightly less pollutants on a g/s basis released from the biogas engines and the velocity is significantly higher. As such the dispersion is expected to be significantly better than the Permitted scenario.

5.4 Source and emissions data – flare

The source and emissions input data utilised within the modelling for the flare are presented in Table 22 to Table 23. All data for the flare has been provided by the technology provider based on the detailed design calculations for the flare installed. The details of the "Permitted" flare are taken from the Air Quality Assessment[5] submitted in support of the 2013 EP application which was based on design data for the anaerobic digestion facility. For the purpose of this assessment the ELVs are as set out in the existing EP.

Table 22: Source Data – Flare

Item	Unit	Permitted	Proposed
Stack data			
Height	m	7.74	
Internal diameter	m	1.270	1.833
Stack location	m, m	508493.34, 168747.48	
Flue gas conditions			
Temperature	°C	1,000	1,000
Exit moisture content	% v/v	9.0	6.8
	kg/kg	0.059	0.044
Exit oxygen content	% v/v dry	5.0	14.6
Reference oxygen content	% v/v dry	3.0	3.0
Volume at reference conditions (273.15K, dry, ref O_2)	Nm^3/h	6,090	7,843
	Nm^3/s	1.69	2.18
Volume at actual conditions	Am^3/h	35,106	110,729
	Am^3/s	9.75	30.76
Flue gas exit velocity	m/s	7.70	11.66

[5] S1253-0120-0002RSS Air Quality Assessment 2013_Issue4_FINAL dated 19 October 2013

Table 23: Stack Emissions Data - Periodic ELV – Flare

Pollutant	Daily or Periodic	Permitted	Proposed
	Conc. (mg/Nm^3, unless stated)	Release rate (g/s, unless stated)	
Oxides of nitrogen (as NO_2)	150	0.254	0.327
Sulphur dioxide	395	0.668	0.861
Carbon monoxide	50	0.085	0.109
Volatile organic compounds (as TOC)	10	0.017	0.022
Notes: *All emissions are expressed at reference conditions of dry gas, 3% oxygen, 273.15K.*			

As shown, the release rate of pollutants is higher for the Proposed scenario. However, there is also a significantly higher flue gas exit velocity which will improve dispersion.

5.5 Source and emissions data – odour

The source and emissions input data utilised within the modelling for the odour control stack and SBR tanks are presented in Table 24. All data has been provided by the technology provider based on the detailed design calculations for the odour control system and the SBR tank.

The odour release concentration for the odour control stack assumes an odour release concentration pre-treatment of 20,000 OUE/m^3 and a guarantee of 1,000 OUE/m^3. The odour release concentration for the SBR tanks has been provided by the technology provider Monsal based on its experience.

Table 24: Source Data – Odour Sources

Item	Unit	Odour Control Stack (x2)	SBR Tank
Stack data			
Height	m	49	11.5
Internal diameter	m	1.12	0.45
Stack location	m, m	508481.83, 168646.18 508483.92, 168464.18	508467.4, 168716.0
Flue gas conditions			
Temperature	°C	Ambient	25
Volume at actual conditions	Am^3/h	61,200	4,277
	Am^3/s	17.00	1.19
Flue gas exit velocity	m/s	17.3	7.5
Odour emissions			
Odour release concentration	OU_E/m^3	1,000	-

Item	Unit	Odour Control Stack (x2)	SBR Tank
Odour release rate	OU_E/s	17,000	337

5.6 Other inputs

Modelling has been undertaken over a grid of 3.0 x 3.0 km with grid spacing of 30 m, with a nested grid of 0.9 x 0.9 km with a grid spacing of 9 m. The nested grid option has been used to ensure that the process contribution around the point of maximum impact is accurately represented, while also covering a wider area to consider the more distant receptors. Reference should be made to Figure 6 of Appendix A for a graphical representation of the modelling domain.

Table 25: Modelling Domain

Nested grid	Nested grid	Wider area
Grid Spacing (m)	9	30
Number of points	101 x 101	101 x 101
Grid Start X	508050	507000
Grid Finish X	508950	510000
Grid Start Y	168150	167200
Grid Finish Y	169150	170200

5.6.1 Meteorological data and surface characteristics

The impact of meteorological data has been taken into account by using meteorological data from the Heathrow Airport meteorological recording station for the years 2017 – 2021 sourced from Air Pollution Services (APS) Limited. Heathrow Airport monitoring station is located approximately 8 km to the north of the Facility. The location of the site is shown on Figure 6 of Appendix A.

Wind roses for each year of meteorological data are provided in Figure 10 of Appendix A.

The minimum Monin-Obukhov length utilised in ADMS can be selected for both the dispersion site and meteorological site. This is a measure of the minimum stability of the atmosphere and can be adjusted to account for urban heat island effects which prevent the atmosphere in urban areas from ever becoming completely stable. Surface conditions at the Facility are mixed urban in fields on the edge of the London whilst conditions at Heathrow are predominately dominated by the airport which is a mixture of runways and grassland with the wider area including residential areas and fields. As such, the minimum Monin-Obukhov length has been set to 30 m at the dispersion site and the meteorological site as is appropriate for cites and large towns and mixed urban areas.

The surface roughness length utilised in ADMS can additionally be selected for both the dispersion site and meteorological site. The surface roughness length varies widely across the modelling domain, from very low values over the water-bodies to much higher values over built-up areas. To account for the varying surface roughness length, spatially-varying surface roughness files have been generated for each of the output grid extents shown in Table 36. The land-use class for each point in the file has been extracted from the CORINE Land Cover database[6] and cross-referenced

6 https://land.copernicus.eu/pan-european/corine-land-cover

with the most likely surface roughness length value[7]. Reference should be made to Figure 7 of Appendix A for a visualisation of the surface roughness file used.

Table 26: Terrain and Surface Roughness Extents

Terrain and surface roughness	Grid
Processing resolution	64 x 64
Grid Start X	506475
Grid Finish X	510525
Grid Start Y	166675
Grid Finish Y	170725

The surface roughness for the meteorological site has been set to 0.5 m which is appropriate considering the immediate land use surrounding the meteorological site.

5.6.2 Terrain

Where gradients within 500 m of the modelling domain are greater than 1 in 10, it is recommended by CERC that the complex terrain module within ADMS (FLOWSTAR) should be used.

A terrain file to cover the output grid of points set out in Table 26 was created using Ordnance Survey Terrain 50 data. Reference should be made to Figure 8 of Appendix A for a visualisation of the terrain file used.

Some of the ecological receptors lie outside of the extents of the variable surface roughness and terrain. As such the results for these locations have been obtained by running the model without terrain and surface roughness files, in this case the surface roughness value for the modelling domain has been set to 0.5 m, as this is considered most appropriate given the mix of land uses.

5.6.3 Buildings

The presence of adjacent buildings can significantly affect the dispersion of the atmospheric emissions in various ways:

- Wind blowing around a building distorts the flow and creates zones of turbulence. The increased turbulence can cause greater plume mixing.
- The rise and trajectory of the plume may be depressed slightly by the flow distortion. This downwash leads to higher ground level concentrations closer to the stack than those which would be present without the building.

The EA recommends that buildings should be included in the modelling if they are both:

- Within 5L of the stack (where L is the smaller of the building height and maximum projected width of the building); and
- Taller than 40% of the stack.

The ADMS 5.2 user guide also states that buildings less than one third of the stack height will not have any effect on the dispersion calculations in the model.

[7] Taken from "Roughness length classification of Corine Land Cover classes", Megajoule Consultants, 2007

A review of the site layout has been undertaken and the details of the applicable buildings are presented in Table 27. A site plan showing which buildings have been included in the model is presented in Figure 9 of Appendix A.

Table 27: Building Details

Buildings	Centre point		Height (m)	Length (m)	Width (m)	Angle (°)
	X (m)	Y (m)				
Main building	508509.6	168567.7	18.5	115.0	75.7	2.1
Silo & bag storage	508525.3	168633.4	14.0	20.0	48.9	2.1
Condensers	508492.0	168636.2	13.0	14.9	15.6	2.1
AD Reception	508536.6	168680.0	13.5	47.0	30.0	2.1
CHP Engine 1	508508.4	168712.4	4.2	2.3	12.2	2.1
CHP Engine 2	508508.2	168707.5	4.2	2.3	12.2	2.1
Buffer tank	508545.9	168715.7	16.7	11.6	11.6	-
AD1	508542.2	168733.6	15.3	18.6	18.6	-
AD2	508520.5	168736.2	15.3	19.6	19.6	-
PDST	508506.9	168725.2	9.3	8.0	8.0	-
SBR	508467.4	168716.0	9.2	17.0	17.0	-
SBR Feed tank	508483.1	168710.2	9.0	6.6	6.6	-
Gas Holder	508477.1	168734.5	14.1	17.0	17.0	-
NaOH	508484.3	168719.8	5.0	3.8	3.8	-
Ash Collection Build	508465.3	168585.7	14.0	25.0	14.0	2.1
Main Building part 2	508525.2	168634.3	18.5	19.0	50.0	2.1
AD Building 1	508508.2	168690.4	13.5	29.0	28.0	2.1
AD Building 2	508537.1	168679.9	13.5	48.0	31.0	2.1
Firewater tank	508464.9	168566.8	13.0	10.0	10.0	-
Reception	508463.8	168695.3	11.0	22.0	50.0	2.1

5.6.4 Wind turbines

Wind turbines have the potential to affect the dispersion of emissions if the wind is blowing from the stack towards the turbines, or from the turbines to the stack, causing a wake. This can be accounted for within ADMS by using the wind turbines module. However, wind turbine wakes are generally dissipated within 12-15 rotor diameters, with the wind turbine effects becoming more noticeable when the stack is within a few rotor diameters of the turbine.

No wind turbines have been identified in the local area and as such this has not been included in the model. The closest turbines have been identified using the renewables UK map function. This is located in Isleworth approximately 10 km to the north-east of the Facility.

5.7 Chemistry

The Facility will release nitric oxide (NO) and nitrogen dioxide (NO_2) which are collectively referred to as oxides of nitrogen (NOx). In the atmosphere, NO will be converted to NO_2 in a reaction with ozone (O_3) which is influenced by solar radiation. Since the AQALs are expressed in terms of NO_2, it is important to be able to assess the conversion rate of NO to NO_2.

Ground level NOx concentrations have been predicted through dispersion modelling. NO_2 concentrations reported in the results section assume 70% conversion from NOx to NO_2 for annual means and a 35% conversion for short term (hourly) concentrations, based upon the worst-case scenario specified in the EA's guidance for dispersion modelling[8] which is appropriate where the primary NO_2 to NOx ratio is less than 10%. Given the short travel time to the areas of maximum concentrations, this approach is considered conservative.

5.8 Baseline concentrations

Baseline concentrations for the assessment have been derived from monitoring and national mapping as summarised in Table 13. For short term averaging periods, the baseline concentration has been assumed to be twice the long-term ambient concentration in accordance with the Air Emission Guidance.

The baseline has been used to define the total PEC. However, where the contribution from the Facility cannot be screened out as insignificant additional consideration has been made of the contribution from road sources to determine an appropriate baseline concentration for the specific receptors of concern. No other significant point sources have been identified in the local area.

[8] https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

6 Sensitivity Analysis

The sensitivity of the results to varying the following model input parameters has been considered:

1. Surface roughness;
2. Terrain;
3. Buildings;

This has been carried out to determine the effect of the choice of these model input parameters of the predicted dispersion of emissions from each source. In addition to the quantitative analysis of the above input parameter, a qualitative analysis of the effect of operating below the design point and the choice of meteorological data has been carried out.

6.1 Surface roughness

The sensitivity of the results to using varying surface roughness length has been considered by running the model with a variable surface roughness file and a constant surface roughness value across the modelling domain. For all sensitivity analysis the impact of changing model parameters on the maximum annual mean and short-term concentrations of a release rate of 1 g/s from the gasification plant, the biogas engines and flare have been considered.

The following parameters have been kept constant:

- Stack height gasifier and biogas engine – 49 m, flare – 7.74 m;
- Grid – 3 km x 3 km with a spatial resolution of 30 m 0.9 x 0.9 km grid nested with a spatial resolution of 9 m;
- Buildings – included;
- Terrain file – included 64 x 64;
- Meteorological site surface roughness – 0.5 m;
- Dispersion and meteorological site Monin-Obukhov length – 30 m; and
- Meteorological data used – Heathrow Airport 2020.

The ground level concentration based on a 1 g/s release rate at the point of maximum impact, and the maximum impacted receptor are presented in Table 28. In addition, the difference between in impact from the use of the variable surface roughness file has been calculated. Where the impact is less than using the variable surface roughness file this is highlighted in green, and where the impact is greater this is highlighted in yellow.

Table 28: Surface Roughness Sensitivity Analysis

Surface roughness (m)	As % of variable surface roughness file			
	Point of maximum impact		Maximum impacted receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
Gasification plant				
0.2	88%	94%	108%	94%
0.3	97%	103%	117%	94%
0.5	112%	108%	128%	97%

Surface roughness (m)	As % of variable surface roughness file			
	Point of maximum impact		Maximum impacted receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
1.0	141%	134%	145%	100%
Biogas engines				
0.2	84%	90%	97%	98%
0.3	94%	97%	104%	97%
0.5	109%	106%	113%	94%
1.0	136%	131%	126%	91%
Flare				
0.2	99%	101%	106%	110%
0.3	94%	94%	102%	102%
0.5	84%	91%	98%	91%
1.0	82%	47%	98%	77%

This analysis shows that the model is sensitive to the choice of surface roughness value.

The flare has the greatest variability suggesting that the choice surface roughness is more sensitive for the lower stack height. For the gasification plant and biogas engines if a constant surface roughness value of 0.5 m or greater is used the maximum predicted impacts is greater than using the variable surface roughness. As shown in Figure 7 of Appendix A the surface roughness is variable in the local area the majority of the area does not have a surface roughness value of more than 0.5 m. Therefore, it is considered appropriate to use a variable surface roughness file to most accurately represent the surface roughness in the local area.

6.2 Terrain

The sensitivity of the results to the effect of terrain has been considered by running the model with and without the terrain file.

The following parameters have been kept constant:

- Stack height gasifier and biogas engine – 49 m, flare – 7.74 m;
- Grid – 4 km x 4 km with a spatial resolution of 30 m 0.9 x 0.9 km grid nested with a spatial resolution of 9 m;
- Buildings – included;
- Dispersion site surface roughness – variable;
- Meteorological site surface roughness – 0.5 m;
- Dispersion and meteorological site Monin-Obukhov length – 30 m; and
- Meteorological data used – Heathrow Airport 2020.

The ground level concentration based on a 1 g/s release rate at the point of maximum impact, and the maximum impacted receptor are presented in Table 29. In addition, the difference between in impact from the use of the terrain file has been calculated. Where the impact is less than using the terrain file this is highlighted in green, and where the impact is greater this is highlighted in yellow.

Table 29: Effect of Terrain and Surface Roughness Resolution

Scenario	As % of including terrain and surface roughness			
	Point of maximum impact		Maximum impacted receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
Gasification plant				
Excluding terrain	94%	100%	91%	102%
Biogas engines				
Excluding terrain	94%	102%	100%	103%
Flare				
Excluding terrain	92%	102%	100%	117%

This analysis shows that the model is only slightly sensitive to the use of terrain, as would be expected given the limited terrain features in the local area as shown on Figure 8 of Appendix A. Although terrain has a minimal effect this has been included in the modelling.

6.3 Building parameters

ADMS 5.2 has a buildings effects module to account for the impact of buildings when it calculates the air flow and dispersion of pollutants from a source. The model works by combining the inputted individual buildings into a single effective building for each wind direction.

The sensitivity of the results to the effect of buildings has been considered by running the model with the buildings presented in Table 27.

The following parameters have been kept constant:

- Stack height gasifier and biogas engine – 49 m, flare – 7.74 m;
- Grid – 4 km x 4 km with a spatial resolution of 30 m 0.9 x 0.9 km grid nested with a spatial resolution of 9 m;
- Terrain file – included at 64 x 64 resolution;
- Dispersion site surface roughness – variable at 64 x 64 resolution;
- Meteorological site surface roughness – 0.5 m;
- Dispersion and meteorological site Monin-Obukhov length – 30 m; and
- Meteorological data used – London Heathrow 2020.

The ground level concentration based on a 1 g/s release rate at the point of maximum impact, and the maximum impacted receptor are presented in Table 30. In addition, the difference between in impact including the buildings has been calculated. Where the impact is less than including buildings this is highlighted in green, and where the impact is greater this is highlighted in yellow.

Table 30: Effect of Buildings

Scenario	As % of including terrain and surface roughness			
	Point of maximum impact		Maximum impacted receptor	
	Annual mean	Max 1-hour mean	Annual mean	Max 1-hour mean
Gasification plant				
Excluding terrain	92%	32%	100%	99%
Biogas engines				
Excluding terrain	86%	35%	90%	99%
Flare				
Excluding terrain	11%	19%	90%	92%

This analysis shows that the buildings have a large effect on dispersion both at the point of maximum impact, and maximum impacted receptor. This is expected given the size and proximity of the buildings to the stacks. As such it is considered appropriate to include the effects of buildings in the modelling.

The main building has been selected as the main process building for the gasification plant and biogas engines, and gas holder for the flare. This is considered appropriate given the site layout and the likely structures having the greatest effect on dispersion and no further sensitivity analysis of this choice of main building has been included for.

6.4 Operating below the design point

Dispersion modelling for the gasification plant and biogas engines has been undertaken using the emission parameters based on the design point for the equipment. The gasification plant and AD process are operated commercially; therefore, it is beneficial for them to operate at full capacity. If loading does fall below the design point the volumetric flow rate and the exit velocity of the exhaust gases would reduce. The effect of this would be to decrease the quantity of pollutants emitted but also to reduce the buoyancy of the plume due to momentum. The reduction in buoyancy, which would lead to reduced dispersion, would be more than offset by the decrease in the quantity of pollutants being emitted, so that the impact of the gasification plant and biogas engines when running below the design point would be reduced.

Dispersion modelling for the flare has been undertaken using the emission parameters based on the design point for the equipment. The flare would not be operated continuously but operate during periods of maintenance or excess generation of biogas. It would not be commercial to flare biogas for any length of time rather than using the biogas engines as electricity can be produced by processing the biogas in the engines. If loading of the flare is below the design point, the volumetric flow rate and the exit velocity of the exhaust gases would reduce. As with the gasification plant, the effect of this would be to decrease the quantity of pollutants emitted but also to reduce the buoyancy of the plume due to momentum. The reduction in buoyancy, which would lead to reduced dispersion, would be more than offset by the decrease in the quantity of pollutants being emitted, so that the impact of the flare when running below the design point would be reduced.

7 Impact on Human Health

7.1 Screening criteria

The Air Emissions Guidance states that to screen out 'insignificant' process contributions:

- the long-term process contribution must be less than 1% of the long-term environmental standard; and
- the short-term process contribution must be less than 10% of the short-term environmental standard.

Consultation with the EA has confirmed that if the above criteria are achieved, it can be concluded that "it is not likely that emissions would lead to significant environmental impacts" and the process contributions can be screened out.

The long-term 1% process contribution threshold is based on the judgement that:

- it is unlikely that an emission at this level will make a significant contribution to air quality; and
- the threshold provides a substantial safety margin to protect health and the environment.

The short-term 10% process contribution threshold is based on the judgement that:

- spatial and temporal conditions mean that short-term process contributions are transient and limited in comparison with long-term process contributions; and
- the threshold provides a substantial safety margin to protect health and the environment.

If process contributions cannot be screened out, assessment is to be undertaken for the following:

- the predicted environmental concentration (PEC) at the point of maximum impact – defined as the process contribution plus the baseline concentration; and
- the process contribution and PEC at areas of public exposure.

In these cases, consultation with the EA has revealed that if the long-term PEC is below 70% of the AQAL, or the short-term process contribution is less than 20% of the headroom[9] it can be concluded that "there is little risk of the PEC exceeding the AQAL", and the impact can be considered to be 'not significant'.

The EA guidance document 'Guidance on assessing group 3 metals stack emissions from incinerators – V.4 June 2016' ('EA metals guidance') states that where the process contribution for any metal exceeds 1% of the long term or 10% of the short-term environmental standard (in this case the AQAL), this is considered to have potential for significant pollution. Where the process contribution exceeds these criteria, the PEC should be compared to the AQAL. The PEC can be screened out if is less than the AQAL. Where the impact is within these parameters it can be concluded that there is no risk of exceeding the AQAL.

7.2 Scenarios

The following scenarios have been considered:

1. Operation of the gasification plant and biogas engines – standard operations
2. Operation of the gasification plant only;
3. Operation of the biogas engines only;

[9] Calculated as the AQAL minus twice the long-term background concentration.

4. Operation of the flare only; and
5. Operation of the gasification plant, biogas engines and flare.

Under standard operations the gasification plant and biogas engines would operate, they would emit via a common windshield, as such the dispersion is aided by the other source. To fully demonstrate the impact of these sources operating in isolation scenarios 2, 3 and 4 have been considered.

7.3 Results – standard operations - gasification plant and biogas engines

Table 31 and Table 32 present the results of the dispersion modelling of process emissions from the Permitted Facility and the Proposed Facility at the point of maximum impact. This is a summary of the maximum predicted impact using 5-years of weather data. Detailed results tables for the Permitted Facility for each year of weather data are provided in Appendix C and Appendix D for the Proposed Facility. Results are presented as the maximum predicted concentration based on the following:

- Grid – 3 km x 3 km with a spatial resolution of 30 m 0.9 x 0.9 km grid nested with a spatial resolution of 9 m;
- Buildings – included;
- Dispersion site surface roughness – variable;
- Meteorological site surface roughness – 0.5 m;
- Dispersion and meteorological site Monin-Obukhov length – 30 m;
- 5 years of weather data 2017 to 2021 from London Heathrow meteorological recording station;
- Stack height gasifier and biogas engine – 49 m;
- Operation at the long term ELVs for the entire year;
- Operation at the short term ELVs during the worst-case conditions for dispersion of emissions (Table 32 only);
- EA's worst case conversion of NOx to nitrogen dioxide;
- The entire dust emissions consist of either PM_{10} of $PM_{2.5}$;
- The entire VOC emissions are assumed to consist of either benzene or 1,3-butadiene; and
- Cadmium is released at the combined emission limit for cadmium and thallium.

Process contributions that cannot be screened out as 'insignificant' are highlighted. Where the process contribution cannot be screened out as 'insignificant', further analysis has been undertaken.

As shown, in all instances the change at the point of maximum impact is marginal. The increased release rate of pollutants (assuming operation at the ELVs) is offset by the increase in buoyancy of the plume from the increased velocity.

Table 31: Dispersion Modelling Results - Point of Maximum Impact - Daily ELVs

Pollutant	Quantity	Units	AQAL	Bg conc.	Permitted Facility		Proposed Facility		Change		Proposed Facility PEC	
					Max PC	Max PC as % of AQAL	Max PC	Max PC as % of AQAL	PC	PC as % of AQAL	Max	Max as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	24.00	0.30	0.74%	0.27	0.68%	-0.02	-0.06%	24.27	60.68%
	99.79th %ile of hourly means	µg/m³	200	48.00	2.85	1.43%	2.50	1.25%	-0.35	-0.17%	50.50	25.25%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	17.08	2.72	2.18%	1.89	1.51%	-0.83	-0.66%	18.97	15.18%
	99.73rd %ile of hourly means	µg/m³	350	17.08	5.63	1.61%	4.57	1.31%	-1.06	-0.30%	21.65	6.19%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	9.07	3.41%	5.58	2.10%	-3.49	-1.31%	22.66	8.52%
Particulates (PM_{10})	Annual mean	µg/m³	40	24.60	0.03	0.07%	0.01	0.03%	-0.01	-0.03%	24.61	61.53%
	90.4th %ile of daily means	µg/m³	50	49.20	0.03	0.05%	0.05	0.10%	0.02	0.04%	49.25	98.50%
Particulates ($PM_{2.5}$)	Annual mean	µg/m³	20	13.31	0.03	0.13%	0.01	0.07%	-0.01	-0.07%	13.32	66.62%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	43.10	0.43%	27.72	0.28%	-15.38	-0.15%	971.72	9.72%
	Hourly mean	µg/m³	30,000	944	137.86	0.46%	88.85	0.30%	-49.01	-0.16%	1032.85	3.44%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	4.10	0.55%	2.57	0.34%	-1.52	-0.20%	3.99	0.53%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.005	0.03%	0.003	0.02%	-0.003	-0.02%	2.35	14.70%
	Hourly mean	µg/m³	160	4.70	0.82	0.51%	0.32	0.20%	-0.50	-0.31%	5.02	3.14%

Pollutant	Quantity	Units	AQAL	Bg conc.	Permitted Facility		Proposed Facility		Change		Proposed Facility PEC	
					Max PC	Max PC as % of AQAL	Max PC	Max PC as % of AQAL	PC	PC as % of AQAL	Max	Max as % of AQAL
Ammonia	Annual mean	µg/m³	180	1.80	0.03	0.01%	0.03	0.01%	0.0001	0.00005%	1.83	1.01%
	Hourly mean	µg/m³	2,500	3.60	4.10	0.16%	3.21	0.13%	-0.88	-0.04%	6.81	0.27%
VOCs (as benzene)	Annual mean	µg/m³	5	0.91	0.57	11.31%	0.45	9.08%	-0.11	-2.23%	1.36	27.28%
	Daily mean	µg/m³	30	1.82	7.00	23.34%	5.26	17.54%	-1.74	-5.80%	7.08	23.60%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.41	0.57	25.13%	0.45	20.17%	-0.11	-4.96%	0.86	38.39%
Mercury	Annual mean	ng/m³	250	2.80	0.13	0.05%	0.05	0.02%	-0.08	-0.03%	2.85	1.14%
	Hourly mean	ng/m³	7,500	5.60	20.48	0.27%	6.43	0.09%	-14.05	-0.19%	12.03	0.16%
Cadmium	Annual mean	ng/m³	5	0.14	0.13	2.63%	0.05	1.06%	-0.08	-1.58%	0.19	3.86%
	Hourly mean	ng/m³	-	0.28	20.48	-	6.43	-	-14.05	-	6.71	-
PaHs	Annual mean	pg/m³	250	160	1.63	0.65%	1.64	0.66%	0.005	0.002%	161.64	64.66%
Dioxins and Furans	Annual mean	fg/m³	-	32.99	0.26	-	0.21	-	-0.052	-	33.20	-
PCBs	Annual mean	ng/m³	200	0.13	0.01	0.01%	0.01	0.01%	0.0000	0.00002%	0.14	0.07%
	Hourly mean	ng/m³	6,000	0.26	2.05	0.03%	1.61	0.03%	-0.44	-0.007%	1.86	0.03%
Total metals	Annual mean	ng/m³	-	-	1.32	-	0.79	-	-0.52	-	-	-
	Daily mean	ng/m³	-	-	16.30	-	9.19	-	-7.12	-	-	-
	Hourly mean	ng/m³	-	-	204.81	-	96.42	-	-108.39	-	-	-

Notes:

All assessment is based on the maximum PC using all 5 years of weather data.

Assumes the Permitted and Proposed Facility operates for 100 % of the time at the daily ELVs.

Table 32: Dispersion Modelling Results - Point of Maximum Impact - Short-Term ELVs

Pollutant	Quantity	Units	AQAL	Bg conc.	Permitted Facility		Proposed Facility		Change		PEC	
					Max PC	Max PC as % of AQAL	Max PC	Max PC as % of AQAL	PC	PC as % of AQAL	Max	Max as % of AQAL
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	48.00	8.24	4.12%	7.54	3.77%	-0.70	-0.35%	55.54	27.77%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	17.08	12.77	3.65%	12.13	3.46%	-0.64	-0.18%	29.21	8.34%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	20.56	7.73%	14.79	5.56%	-5.77	-2.17%	31.87	11.98%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	56.43	0.56%	37.71	0.38%	-18.72	-0.19%	981.71	9.82%
	Hourly mean	µg/m³	30,000	944	137.86	0.46%	88.85	0.30%	-49.01	-0.16%	1032.85	3.44%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	24.58	3.28%	19.28	2.57%	-5.29	-0.71%	20.70	2.76%
Hydrogen fluoride	Hourly mean	µg/m³	160	4.70	1.64	1.02%	1.29	0.80%	-0.35	-0.22%	5.99	3.74%

Notes:
All assessment is based on the maximum PC using all 5 years of weather data.
Assumes the Permitted and Proposed Facility operates for 100 % of the time at the half-hourly ELVs for the gasification plant and the daily ELV for the biogas engines.

As shown the total impact of the Proposed Facility with the gasification plant and biogas engines operating is less than 1% of the long term AQAL, and less than 10% of the short term AQAL and can be screened out as 'insignificant' for all pollutants except for VOCs and cadmium.

For all of the pollutants released there is a difference in both the velocity and the release rate between the Permitted and Proposed scenario. For the gasification plant there is a difference in the volumetric flow rate but also the ELV which is used to calculate the release rate, with the exception of ammonia. Looking in isolation at the impact of ammonia, it is possible to show that even without any change to the ELV for the pollutants the short term impact of the Proposed Facility is lower than the Permitted Facility, and the long term impact is broadly similar. Therefore, the additional momentum provided by the additional fan speed, offsets the increase in the release rate of pollutants even excluding the effects of any reduction in the ELV from the implementation of the WI BREF.

7.3.1 Further analysis – annual mean nitrogen dioxide

As shown in Table 31, at the point of maximum impact the contribution from the Proposed Facility is predicted to be lower than the Permitted Facility. Although the total mass of emissions of NOx is predicted to be higher for the Proposed Facility (1.659 g/s[10]) than Permitted (1.500 g/s[11]) the reduction in ground levels impacts is attributed to the increase in dispersion due to the increase in velocity.

The total predicted annual mean nitrogen dioxide impact of the Proposed Facility is 0.68% of the AQAL and can be screened out as 'insignificant'.

For completeness the plot file of annual mean nitrogen dioxide impacts is presented in Figure 11 of Appendix A, and the impacts at receptors are shown in Table 33. As shown, at all areas of exposure, the impact of the Proposed Facility is lower than the impact of the Permitted Facility, and the impact of the Proposed Facility can be screened out as "insignificant" as the process contribution is less than 1% of the AQAL.

Table 33: Annual Mean Nitrogen Dioxide Impact at Receptors

Receptor		Permitted Facility		Proposed Facility	
		µg/m³	% of AQAL	µg/m³	% of AQAL
R1	Charlton Road South	0.15	0.38%	0.14	0.34%
R2	Nutty Lane	0.10	0.24%	0.08	0.20%
R3	Charlton Road North	0.04	0.10%	0.03	0.08%
R4	Hetherington Road	0.19	0.47%	0.17	0.41%
R5	Hawthorn Way North	0.06	0.14%	0.04	0.11%
R6	Hawthorn Way South	0.07	0.17%	0.06	0.14%
R7	Watersplash Road	0.08	0.19%	0.07	0.18%
R8	Birch Grove	0.21	0.53%	0.20	0.51%

[10] Calculated as contribution of 1.115 g/s from the gasification plant plus a contribution of 0.272 g/s from each gas engine.

[11] Calculated as contribution of 0.928 g/s from the gasification plant plus a contribution of 0.286 g/s from each gas engine.

7.3.2 Further analysis – annual mean VOCs

As shown in Table 31, at the point of maximum impact the contribution from the Proposed Facility is predicted to be lower than the Permitted Facility. Although the total mass of emissions of VOCs is predicted to be higher for the Proposed Facility (1.924 g/s[12]) than Permitted (1.997 g/s[13]) the reduction in ground levels impacts is attributed to the increase in dispersion due to the increase in velocity.

As shown, if it is assumed that the entire VOCs consist of only benzene or 1,3-butadniene the total predicted annual mean impact of the Proposed Facility is 9.08% of the AQAL for benzene and 17.54% of the AQAL for 1,3-butadiene, and the maximum daily mean process contribution is 17.54% of the daily mean AQAL for benzene. Although this cannot be screened out this conservatively assumes that the entire VOC emissions consist of only benzene or 1,3-butadiene.

The gasification plant contributes only 6% to the total mass release of VOCs from the combined operation of the gasification plant and biogas engines, which is due to the ELV for TOC from the biogas engines. The majority of the VOCs from the AD plant would be methane. SR2010No 15 includes a limit for non-methane VOCs of 75 mg/Nm^3. If it assumed that the release rate of VOCs is 75 mg/Nm^3 from the biogas engines, the maximum process contribution would be 13 % of that presented in the detailed results tables[14] i.e. for the Proposed Facility at the point of maximum impact the annual mean process contribution would be 0.02 µg/m^3, which equates to 0.32% and 0.71% of the annual mean AQAL for benzene and 1,3-butadiene respectively, and the maximum daily mean process contribution would be 0.19 µg/m^3 which equates to 0.62% of the daily mean AQAL for benzene. Based on this assumption the impact of the Proposed Facility can be screened out as "insignificant" at the point of maximum impact and at all areas of relevant exposure.

For completeness the plot file of the annual mean process contribution of VOCs is shown in Figure 12 of Appendix A. This assumes the entire VOC consists of only benzene. This shows that all areas of exposure the impact of the Proposed Facility is lower than the impact of the Permitted Facility.

7.3.3 Further analysis – annual mean cadmium

As shown in Table 31, at the point of maximum impact the contribution from the Proposed Facility is predicted to be lower than the Permitted Facility. This is due to both the reduction in the ELV on the gasification plant and the increase in dispersion due to the increase in velocity.

Furthermore, as shown in Table 31, the total predicted annual mean cadmium impact of the Proposed Facility is 1.3% of the AQAL. Whilst this cannot be screened out as 'insignificant', the predicted change in annual mean impact from the Permitted Facility is a reduction of 1.3% of the AQAL. Therefore, the change in impact can be screened out as 'insignificant'. This conservatively assumes that the Proposed Facility operates at the emission limit for total cadmium and thallium and that the entire emissions only consist of cadmium, which is highly unlikely.

Data submitted by UK plants to the European Waste Incineration BREF working group in 2017 shows that the average cadmium concentration recorded from UK plants equipped with bag filters was 1.6 µg/Nm^3 (or 3.2% of the ELV of 0.02 mg/Nm^3), the highest recorded concentration of cadmium and thallium was 14 µg/Nm^3 (or 28% of the ELV) and only three lines recorded concentrations higher than 10 µg/Nm^3 (or 20% of the ELV of 0.05 mg/Nm^3). Monitoring from the gasification plant has shown that the maximum cadmium and thallium concentration during 2022 was 2.0 µg/Nm^3,

[12] Calculated as contribution of 0.112 g/s from the gasification plant plus a contribution of 0.906 g/s from each gas engine.

[13] Calculated as contribution of 0.093 g/s from the gasification plant plus a contribution of 0.952 g/s from each gas engine.

[14] Calculated as gas engine contribution would be 0.906 x (75/1000) or 0.248 g/s which equates to 13% of that modelled.

and the average was 1.3 µg/Nm^3 (this is 10% and 7% of the ELV of 0.02 mg/Nm^3 respectively) Assuming that the gasification plant operates continually at the maximum monitored total concentration for cadmium and thallium the contribution from the Proposed Facility would be less than 1% of the AQAL and the impact could be screened out as "insignificant".

7.3.4 Further analysis – annual mean particulate matter

As detailed in section 2.1, the WHO recommends guidelines for particulate matter which are more stringent than those currently set in UK legislation. The Environment Act introduces a duty to set a legally binding target for $PM_{2.5}$ although to date[15] this has not been set.

Although the impact of PM emissions at the point of maximum impact and at receptor locations is lower for the Proposed Facility than the Permitted Facility, additional consideration has been made to the effect of a more stringent AQAL than in current legislation. The maximum predicted impact of particulate matter has been compared to the WHO guidelines in Table 34.

Table 34: Further Analysis of PM Impacts

Pollutant	WHO guideline (µg/m^3)	PC at point of maximum impact (% of AQAL)	
		Permitted Facility	Proposed Facility
Annual mean			
PM_{10}	20	0.13%	0.07%
$PM_{2.5}$	10	0.26%	0.13%
Maximum daily mean			
PM_{10}	50	0.34%	0.17%
$PM_{2.5}$	25	0.68%	0.34%

As shown, the maximum predicted annual mean impact for the Proposed Facility can be screened out as 'insignificant' even when applying the long-term guideline value from the WHO for PM_{10} and $PM_{2.5}$. However, these values are conservatively derived assuming that the entire dust emissions consist of only PM_{10} or $PM_{2.5}$ and these are emitted at the ELV for total dust. As such, actual impacts would be significantly lower as the emissions of total dust are well below the current ELV and only a fraction will consist of each particle size. The maximum daily mean is well within the 10% of the short-term guideline value from the WHO. Therefore, the impact of the Proposed Facility can be screened out as "insignificant" taking into consideration the requirements of the Environment Act.

7.3.5 Heavy metals – at the point of maximum impact

As shown in Table 31, at the point of maximum impact the contribution from the Proposed Facility is predicted to be lower than the Permitted Facility. This is due to both the reduction in the ELV on the gasification plant and the increase in dispersion due to the increase in velocity. For completeness Table 35 and Table 36 detail the process contribution from the Proposed Facility and the PEC assuming that each metal is released at the combined metal ELV. This has been presented to demonstrate that, in addition to the change in concentration being able to be screened out as insignificant, the total impact of the Proposed Facility is not significant.

[15] As of 25 November 2022.

If the process contribution is greater than 1% of the AQAL, when it is assumed that each metal is emitted at the total metal ELV, further analysis has been undertaken. The EA's metals guidance details the maximum monitored concentrations of Group 3 metals emitted by Municipal Waste Incinerators and Waste Wood Co-Incinerators as a percentage of the ELV for Group 3 metals. The maximum monitored emission presented in the EA's analysis has been used as a conservative assumption.

As shown in Table 35, if it is assumed that the entire emissions of metals consist of only one metal, the impact of the Proposed Facility is generally less than 1% of the long term, with the exception of annual mean impacts of arsenic, chromium VI, and nickel. The PEC is only predicted to exceed the long term AQAL for chromium VI using this worst-case screening assumption, and this is due to the high assumed background concentrations. If it is assumed that the Proposed Facility would perform no worse than the maximum monitored concentration from the EA metals guidance, the process contribution is below 1% of the long term AQAL for all pollutants, with the exception of annual mean arsenic and nickel. For both arsenic and nickel the PEC is predicted to be well below the AQAL. The PEC is only predicted to exceed the long term AQAL for chromium VI which is due to the assumed high background concentrations, the process contribution is well below 1% of the AQAL (0.14%), and the change from the Permitted Facility can be screened out as insignificant.

Table 36 sets out the maximum 1-hour impact, with the exception of vanadium which is expressed as the maximum 24-hour mean impact. As shown, even if it is assumed that each metal is released at the combined metals ELV the Proposed Facility the process contribution is below 10% of the short term AQAL for all pollutants.

This analysis has shown that the change in impact associated with the increase in throughput is insignificant and it can be concluded that there is no risk of exceeding an AQAL for any metals either on a long-term or short-term basis.

Table 35: Long-Term Metals Results – Point of Maximum Impact – Proposed

Metal	AQAL	Background conc.	Metals emitted at combined metal limit				Metal as % of ELV (1)	Metals emitted at the maximum concentration from the EA metals guidance document			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	6	0.94	0.79	13.21%	1.73	28.88%	8.3%	0.07	1.10%	1.01	16.77%
Antimony	5,000	0.13	0.79	0.02%	0.92	0.02%	3.8%	0.03	0.001%	0.16	0.00%
Chromium	5,000	3.00	0.79	0.02%	3.79	0.08%	30.7%	0.24	0.005%	3.24	0.06%
Chromium VI	0.2	0.60	0.79	317.1%	1.39	557.1%	0.043%	0.00	0.14%	0.60	240.14%
Cobalt	-	0.12	0.79	-	0.91	-	1.9%	0.01	-	0.13	-
Copper	10,000	16.00	0.79	0.01%	16.79	0.17%	9.7%	0.08	0.001%	16.08	0.16%
Lead	250	7.90	0.79	0.32%	8.69	3.48%	16.8%	0.13	0.05%	8.03	3.21%
Manganese	150	6.70	0.79	0.53%	7.49	5.00%	20.0%	0.16	0.11%	6.86	4.57%
Nickel	20	0.94	0.79	3.96%	1.73	8.66%	73.3%	0.58	2.91%	1.52	7.61%
Vanadium	-	2.20	0.79	-	2.99	-	2.0%	0.02	-	2.22	-

Notes:
Assumes that the gasification plant continually operates at the daily ELV and includes the effects of the biogas engines operating on the buoyancy of the plume.
(1) Metal as maximum percentage of the group 3 IED ELV, as detailed in the EA metals guidance document (V.4) Table A1.

Table 36: Short-Term Metals Results – Point of Maximum Impact – Proposed

Metal	AQAL	Background conc.	Metals emitted at combined metal limit				Metal as % of ELV [(1)]	Metals emitted at the maximum concentration from the EA metals guidance document			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	-	1.88	96.42	-	98.30	-	8.3%	8.04	-	9.92	-
Antimony	150,000	0.26	96.42	0.06%	96.68	0.06%	3.8%	3.70	0.002%	3.96	0.003%
Chromium	150,000	6.00	96.42	0.06%	102.42	0.07%	30.7%	29.57	0.02%	35.57	0.02%
Chromium VI	-	1.20	96.42	-	97.62	-	0.043%	0.04	-	1.24	-
Cobalt	-	0.24	96.42	-	96.66	-	1.9%	1.80	-	2.04	-
Copper	200,000	32.00	96.42	0.05%	128.42	0.06%	9.7%	9.32	0.005%	41.32	0.02%
Lead	-	15.80	96.42	-	112.22	-	16.8%	16.17	-	31.97	-
Manganese	1,500,000	13.40	96.42	0.01%	109.82	0.01%	20.0%	19.28	0.001%	32.68	0.002%
Nickel	-	1.88	96.42	-	98.30	-	73.3%	70.71	-	72.59	-
Vanadium	1,000	2.20	9.19	0.92%	11.39	1.14%	2.0%	0.18	0.018%	2.38	0.24%

Notes:
Assumes that the gasification plant continually operates at the daily ELV and includes the effects of the biogas engines operating on the buoyancy of the plume.
All impacts presented as the maximum 1-hour with the exception of vanadium which is the 24-hour mean.
*[(1)] Metal as maximum percentage of the group 3 IED ELV, as detailed in the EA metals guidance document (*V.4) Table A1.

7.4 Results – non-standard operations

The detailed results tables provided in Appendix C and Appendix D show that, when the biogas engines are offline, the impact of the pollutants which are released from both the gasification plant and biogas engines (i.e. oxides of nitrogen, sulphur dioxide, carbon monoxide and VOC) are reduced. However, those pollutants which are only released from the gasification plant no longer benefit from the additional dispersion. Taking, for example, ammonia impacts (which is only released from the gasification plant) the following table summarises the impact of the gasification plant operating in isolation, and when the flow from the biogas engines is combined with the flow from the gasification plant.

Table 37: Effect of Not Operating Gas Engines on Emissions from Gasification Plant

Averaging period	Gasification Plant only	Gasification Plant and Biogas engines	Difference
Annual mean	0.04	0.03	21%
Maximum hourly mean	6.33	4.02	58%

The detailed results tables provided in Appendix C and Appendix D show that even if the biogas engines are not operating the impact of emissions from the gasification plant can be screened out as “insignificant” with the exception of annual mean VOCs (assuming that the entire VOC emissions consists of only 1,4-butadiene) and cadmium (assuming that cadmium emissions are released at the cadmium and thallium ELV). The impact of cadmium is lower for the Proposed Facility than the Permitted Facility due to the reduction in the ELV. However, as there is no change to the ELV proposed for VOCs the impact of VOC emissions for the Proposed Facility when only the gasification plant is operational is slightly greater than for the Permitted Facility. At the point of maximum impact, the impact of VOC emissions from the gasification plant assuming that the entire VOC emissions are only 1,3-butaidnee are increased from 1.30% of the AQAL to 1.42% of the AQAL. This is not a significant change.

7.5 Results – operation of the flare

The flare will only operate during periods of maintenance of excess generation of biogas and will be limited by not operating for more than 10% of the time in any year. Like the biogas engines ELVs are set in the existing EP for oxides of nitrogen, sulphur dioxide, carbon monoxide and VOCs. Therefore, this analysis has only focussed on these pollutants.

The flare will only operate when the biogas engines are not operational, or there is an excess production of biogas for it to be combusted in the biogas engines. Therefore, the focus of this analysis is on the short-term objectives which are measured over 15 and 60 minutes. The modelling has assumed that the flare operates for the full year to ensure that the worst-case weather conditions for dispersion are taken into account. However, this is not a realistic situation, as the flare would typically not operate for more than 10% of the time over an annual period.

The detailed results tables are provided in Appendix C and Appendix D and a summary provided in Table 38. As shown the impact of the flare for the Proposed Facility is lower than the Permitted Facility. Whilst the impact of the Proposed Facility cannot be screened out as “insignificant” there is not predicted to be any exceedances of the AQAL. Although the release rate of pollutants is higher than assumed in the original AQA, the increase in temperature provides much better dispersion leading to lower ground level impacts.

Figure 13 and Figure 14 of Appendix A shows the plot file of 1-hour and 15-mintue sulphur dioxide impacts from the flare in isolation respectively. As shown the area where impacts cannot be screened out as "insignificant" is restricted to an area close to the Facility. Whilst there is the potential for people to be along the footpath the likelihood this occurs both when the flare is operating and during the worst-case conditions for dispersion is low. In addition, the AQAL is not predicted to be exceeded. Therefore, this is not considered to be a significant impact.

Additional analysis has been carried out to determine the impact of the flare and the gasification plant. This assumes that the worst-case weather conditions occur when:

- the biogas engines are not operational due to maintenance
- the flare is operating; and
- the gasification plant being operated at maximum capacity at the half-hourly ELVs.

The flare is predicted to operate for less than 10% of the year, therefore an assessment of the continuous operation of the gasification plant at the half-hourly ELV and the flare is considered to be highly conservative.

As shown in Figure 15 and Figure 16 of Appendix A, the impact of emissions from the flare and gasification plant operating in this manner are predicted to be less than the Permitted Facility. The peak impact is mainly influenced by the impact from the flare. No exceedances of the AQAL are predicted. Although the impact sulphur dioxide emission cannot be screened out as "insignificant", when considering the local background concentrations the PEC is less than 75% of the AQAL and as stated previously, the impact of the flare for the Proposed Facility is lower than the Permitted Facility., Therefore, there is little risk of exceeding the AQAL and this is not considered to be a significant impact.

The annual mean nitrogen dioxide and VOC impacts have also been considered in Table 67 of Appendix D which assumes that the gasification plant operates at the daily ELV 100% of the time, the biogas engines operate for 90% of the time and the flare 10% of the time. As shown, the additional contribution from the flare slightly increases concentrations close to the site, but at areas of relevant exposure there is very little difference in predicted annual mean impacts as a result of the operation of the flare.

Table 38: Summary of Impact of Flare

Pollutant	Quantity	Units	AQAL	Bg conc.	Permitted Facility		Proposed Facility		Change		Proposed Facility PEC	
					Max PC	Max PC as % of AQAL	Max PC	Max PC as % of AQAL	PC	PC as % of AQAL	Max	Max as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	24.00	0.67	1.7%	0.61	1.5%	-0.06	-0.1%	24.61	61.5%
	99.79th %ile of hourly means	µg/m³	200	48.00	25.54	12.8%	21.88	10.9%	-3.65	-1.8%	69.88	34.9%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	17.08	186.92	53.4%	163.24	46.6%	-23.68	-6.8%	180.32	51.5%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	209.50	78.8%	172.64	64.9%	-36.86	-13.9%	189.72	71.3%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	26.71	0.3%	19.99	0.2%	-6.72	-0.1%	963.99	9.6%
	Hourly mean	µg/m³	30,000	944	74.45	0.2%	21.73	0.1%	-52.72	-0.2%	965.73	3.2%
VOCs (as benzene)	Annual mean	µg/m³	5	0.91	0.06	1.3%	0.06	1.2%	-0.01	-0.1%	0.97	19.4%
	Daily mean	µg/m³	30	1.82	3.77	12.6%	3.57	11.9%	-0.20	-0.7%	5.39	18.0%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.41	0.06	2.8%	0.06	2.6%	-0.01	-0.2%	0.47	20.8%

Notes:

Assumes continuous operation at the ELVs.

When calculating annual mean impacts it is assumed that the flare is operational for 10% of the year.

Maximum outside of the installation boundary.

8 Impact at Ecological Receptors

8.1 Screening

The Air Emissions Guidance states that to screen out impacts as 'insignificant' at European and UK statutory designated sites:

- the long-term PC must be less than 1% of the long-term environmental standard (i.e. the Critical Level or Load); and
- the short-term PC must be less than 10% of the short-term environmental standard.

If the above criteria are met, no further assessment is required. If the long-term PC exceeds 1% of the long-term environmental standard, the PEC must be calculated and compared to the standard. If the resulting PEC is less than 70% of the long-term environmental standard, the Air Emissions Guidance states that the emissions are 'insignificant' and further assessment is not required. In accordance with the guidance, calculation of the PEC for short-term standards is not required.

In addition, the Air Emissions Guidance states that to screen out impacts as 'insignificant' at local nature sites[16]:

- the long-term PC must be less than 100% of the long-term environmental standard; and
- the short-term PC must be less than 100% of the short-term environmental standard.

Therefore, in accordance with the Air Emissions Guidance, calculation of the PEC for local nature sites is not required. However, this has been included for completeness.

8.2 Methodology

8.2.1 Atmospheric emissions – Critical Levels

The impact of emissions has been compared to the Critical Levels listed in Table 3. Further assessment would be undertaken where the process contribution of a particular pollutant is greater than 1% of the long term or 10% of the short-term Critical Level for European and UK designated sites, and where the process contribution of a particular pollutant is greater than 100% of the Critical Level for locally designated sites.

8.2.2 Deposition of emissions – Critical Loads

In addition to the Critical Levels for the protection of ecosystems, habitat specific Critical Loads for nature conservation sites at risk from acidification and nitrogen deposition (eutrophication) are outlined in APIS. In terms of acid deposition, the APIS Database contains a maximum critical load for sulphur (CLmaxS), a minimum Critical Load for nitrogen (CLminN) and a maximum Critical Load for nitrogen (CLmaxN). These components define the Critical Load function for acid deposition. Where the acid deposition flux falls within the area under the Critical Load function, no exceedances are predicted.

An assessment has been made for each habitat feature identified in APIS for the specific site. The site-specific features tool has been used to identify the feature habitats, and then the APIS web GIS to find the habitat specific Critical Load for the specific points assessed within the designated sites.

[16] Ancient woodlands, local wildlife sites and national and local nature reserves.

APIS does not display the Critical Loads for Ramsar sites. The only Ramsar site within 10 km of the Facility is the South West London Water Bodies which is also an SPA and SSSI for which Critical Loads are available. The relevant Critical Loads are presented in Appendix B. The lowest Critical Load for each designated site has been used to ensure a robust assessment.

8.2.3 Calculation methodology

8.2.3.1 Nitrogen deposition

The impact of deposition has been assessed using the methodology detailed within the Habitats Directive AQTAG 6 (March 2014). The steps to this method are as follows.

1. Determine the annual mean ground level concentrations of nitrogen dioxide and ammonia at each site.
2. Calculate the dry deposition flux (µg/m^2/s) at each site by multiplying the annual mean ground level concentration by the relevant deposition velocity presented in Table 39.
3. Convert the dry deposition flux into units of kgN/ha/yr using the conversion factors presented in Table 39.
4. Compare this result to the nitrogen deposition Critical Load.

Table 39: Deposition Factors

Pollutant	Deposition velocity (m/s)		Conversion factor (µg/m^2/s to kg/ha/year)
	Grassland	Woodland	
Nitrogen dioxide	0.0015	0.003	96.0
Sulphur dioxide	0.0120	0.024	157.7
Ammonia	0.0200	0.030	259.7
Hydrogen chloride	0.0250	0.060	306.7

Source: AQTAG 6 (March 2014)

8.2.3.2 Acidification

Deposition of nitrogen, sulphur, hydrogen chloride and ammonia can cause acidification and are required to be taken into consideration when assessing the impact of the Facility.

The steps to determine the acid deposition flux are as follows.

1. Determine the dry deposition rate in kg/ha/yr of nitrogen, sulphur, hydrogen chloride and ammonia using the methodology outlined in section 8.2.3.1.
2. Apply the conversion factor for N outlined in Table 39 to the nitrogen and ammonia deposition rate in kg/ha/year to determine the total keq N/ha/year.
3. Apply the conversion factor for S to the sulphur deposition rate in kg/ha/year to determine the total keq S/ha/year.
4. Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the dry keq Cl/ha/year.

5. Multiply the dry deposition rate of HCl by two to determine the wet deposition rate[17].
6. Add the contribution from S to HCl dry and wet and treat this sum as the total contribution from S.
7. Plot the results against the Critical Load functions.

Table 40: Conversion Factors

Pollutant	Conversion factor (kg/ha/year to keq/ha/year)
Nitrogen	Divide by 14
Sulphur	Divide by 16
Hydrogen chloride	Divide by 35.5

Source: AQTAG 6 (March 2014)

The March 2014 version of the AQTAG 6 document states that, for installations with an HCl emission, the PC of HCl, in addition to S and N, should be considered in the acidity Critical Load assessment. The H+ from HCl should be added to the S contribution (and treated as S in APIS tool). This should include the contribution of HCl from wet deposition.

The contribution from the Facility has been calculated using APIS formula:

Where PEC N Deposition < CLminN:

PC as % of CL function = PC S deposition / CLmaxS

Where PEC N Deposition > CLminN:

PC as % of CL function = (PC S + N deposition) / CLmaxN

8.3 Results

Detailed results tables for the Permitted Facility are provided in Appendix C and in Appendix D for the Proposed Facility, and Appendix E for the change in impact. Results are presented as the maximum predicted concentration based on the following:

- Grid – 3 km x 3 km with a spatial resolution of 30 m 0.9 x 0.9 km grid nested with a spatial resolution of 9 m;
- Buildings – included;
- Dispersion site surface roughness – variable;
- Meteorological site surface roughness – 0.5 m;
- Dispersion and meteorological site Monin-Obukhov length – 30 m;
- 5 years of weather data 2017 to 2021 from London Heathrow meteorological recording station;
- Stack height gasifier and biogas engine – 49 m;
- Operation at the long term ELVs for the entire year for the gasification plant and biogas engines;
- EA's worst case conversion of NOx to nitrogen dioxide;

[17] Consultation with AQMAU confirmed that the maximum of the wet or dry deposition rate for HCl should be included in the calculation. For the purpose of this analysis, it has been assumed that wet deposition of HCl is double dry deposition.

- For the initial screening it has been assumed that the daily mean Critical Level for oxides of nitrogen is 75 µg/m^3;
- The nitrogen deposition impacts include the contribution from nitrogen dioxide and ammonia emissions;
- The acid deposition impacts include the contribution from nitrogen dioxide, ammonia, sulphur dioxide and hydrogen chloride;
- Wet deposition of HCl has been included in the acid S calculation as double dry deposition; and
- It has been assumed the most sensitive habitat is present at the point of maximum impact of emissions in each site.

As shown in Appendix E, at each of the identified ecological receptors, the change in impact is less than 1% of the long term Critical Levels and Critical Loads and less than 10% of the short term Critical Levels and can be screened out as 'insignificant'.

When considering the impact of the Proposed Facility, as shown in Appendix D, at each of the identified European and UK designated ecological receptors, the impact of the Proposed Facility is less than 1% of the long term Critical Levels and Critical Loads and less than 10% of the short term Critical Levels and can be screened out as 'insignificant'.

When considering the impact of the Proposed Facility, as shown in Appendix D, at each of the identified local ecological receptors, the impact of the Proposed Facility is less than the long-term Critical Levels and Critical Loads and can be screened out as 'insignificant'

9 Impact of odour

There are a number of other potential sources of odour on site. These are associated with the waste management activities which are regulated by the EP. In accordance with the requirements of the EP, an odour management plan is in place which includes measures to minimise the potential for any adverse odour impacts.

Of the sources of odour there are two-point sources; the extraction from the odour control system from the main building and the SBR tank. The predicted impacts of these point sources on the local environment have been assessed.

9.1 Assessment criteria

Odours are characterised in terms of European odour units, OU, and odour concentrations, OU_E/m^3.

- The OU strength of a release is the number of times the mixture must be diluted, at standard temperature and pressure, to reach the detection limit. A release of 1 OU can be detected by half of the members of an olfactory panel.
- One OU_E is the mass of a pollutant that, when evaporated into 1 m^3 of odourless gas, has the same odour nuisance as 1 OU of reference odorant.

The EA's H4 Odour Management guidance (2011) provides guidance on the odour exposure criteria for permitting. The EA H4 benchmark odour criteria are as follow:

- 98^{th} percentile of 1.5 OU_E/m^3 for the most offensive odours (e.g. decaying animal or fish remains, septic effluent or sludge, biological landfill);
- 98^{th} percentile of 3.0 OU_E/m^3 for moderately offensive odours (e.g. intensive livestock rearing, fat frying or food processing, green waste composting); and
- 98^{th} percentile of 6.0 OU_E/m^3 for less offensive odours (e.g. brewery, confectionery, coffee).

9.2 Results

Table 41 presents the results of the odour modelling for each source and the combined impact of the Facility. It has not been deemed appropriate to compare the results to the Permitted Facility as such impacts have only been predicted for as-built design.

The modelling shows that the greatest impact is from the odour control stack, noting that the impact from each source is not in the same location.

The maximum predicted 98^{th} percentile of 1-hour impacts is well below the benchmark criteria for most offensive odours. Therefore, there are not expected to be any unacceptable impacts on odour in the local area from the odour control systems and SBR tank.

For completeness the following plot files are provided in Appendix A:

- Figure 17 – 98^{th} percentile 1-hour odour concentration from the installation

Table 41: Summary of Odour Impact from Modelled Point Sources

Source	98th %ile of 1-hour odour concentration (OU_E/m^3)						Maximum as % of 1.5 OU_E/m^3
	2017	2018	2019	2020	2021	Maximum	
Maximum across grid							
Odour control stack	0.15	0.16	0.16	0.17	0.16	0.17	11.02%
SBR tank	0.09	0.09	0.09	0.09	0.09	0.09	6.11%
Installation	0.16	0.17	0.16	0.17	0.17	0.17	11.44%
Maximum across grid excluding points within the installation boundary							
Odour control stack	0.15	0.16	0.16	0.17	0.16	0.17	11.02%
SBR tank	0.08	0.09	0.09	0.08	0.08	0.09	5.83%
Installation	0.16	0.17	0.16	0.17	0.17	0.17	11.44%
Maximum at an identified receptor location							
Odour control stack	0.14	0.14	0.14	0.15	0.14	0.15	9.73%
SBR tank	0.02	0.02	0.02	0.01	0.01	0.02	1.16%
Installation	0.14	0.14	0.15	0.15	0.15	0.15	10.00%

10 Conclusions

This Dispersion Modelling Assessment has been undertaken to support an application for a variation to the EP for the Facility. As this is a variation to an existing permitted process, comparison has been made with the impact of the Permitted Facility. To ensure that a direct comparison is being made between the Proposed Facility and Permitted Facility dispersion modelling has been carried out for both operating scenarios.

This assessment has included a review of baseline pollution levels, dispersion modelling of emissions and quantification of the impact of these emissions on local air quality.

The primary conclusions of the assessment are presented below.

1. In relation to the impact on human health:
    a. Emissions from the operation of the Proposed Facility will not cause a breach of any AQAL.
    b. The change in impact can be screened out as 'insignificant' and in most instances the impact of the Proposed Facility is lower than the Permitted Facility.
    c. There is no risk of exceeding an AQAL for any metal either on a long-term or short-term basis.
2. In relation to the impact on ecologically sensitive sites:
    a. At all ecological receptors, the change in impact from the Permitted Facility can be screened out as 'insignificant' as it is less than 1% of the long-term Critical Levels and Critical Loads and less than 10% of the short-term Critical Levels.
    b. At all identified European and UK designated ecological receptors, the contribution from the Proposed Facility can be screened out as 'insignificant' as it is less than 1% of the long-term Critical Levels and Critical Loads and less than 10% of the short-term Critical Levels.
    c. At all local ecological sites, the contribution from the Proposed Facility can be screened out 'insignificant' as it is less than 1% of the long-term Critical Levels and Critical Loads and less than 10% of the short term Critical Levels.
3. In relation to the odour impacts:
    a. There is an odour management plan in place which includes measures to minimise the potential for any adverse odour impacts. There are two main point sources of odour; the odour control system from the main building, and the SBR tank. Modelling has shown that the impact of odour from these sources is very small, and well below the benchmark value set for most offensive odour. As such there are not expected to be any unacceptable impacts on odour in the local area from the odour control systems and SBR tank.

In summary, the assessment has shown that the change in air quality impact associated with proposed variation would be 'insignificant'. In addition, the total impact of the Proposed Facility would not have a significant impact on local air quality, the general population or the local community. As such there should be no air quality constraint in granting a variation to the existing EP for the changes to the design as proposed.

Appendices

A Figures

507500 510000

169500

167000

507500 510000

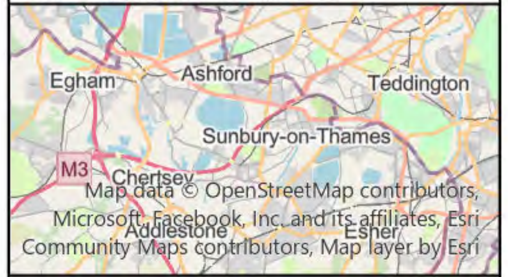
Legend

Installation Boundary

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253
Title:	

Figure 1. Site Location

Drawn by: RSF	Date: 06/12/2022



0 0.2 0.4 0.8 km

N

Scale: 1:20,000

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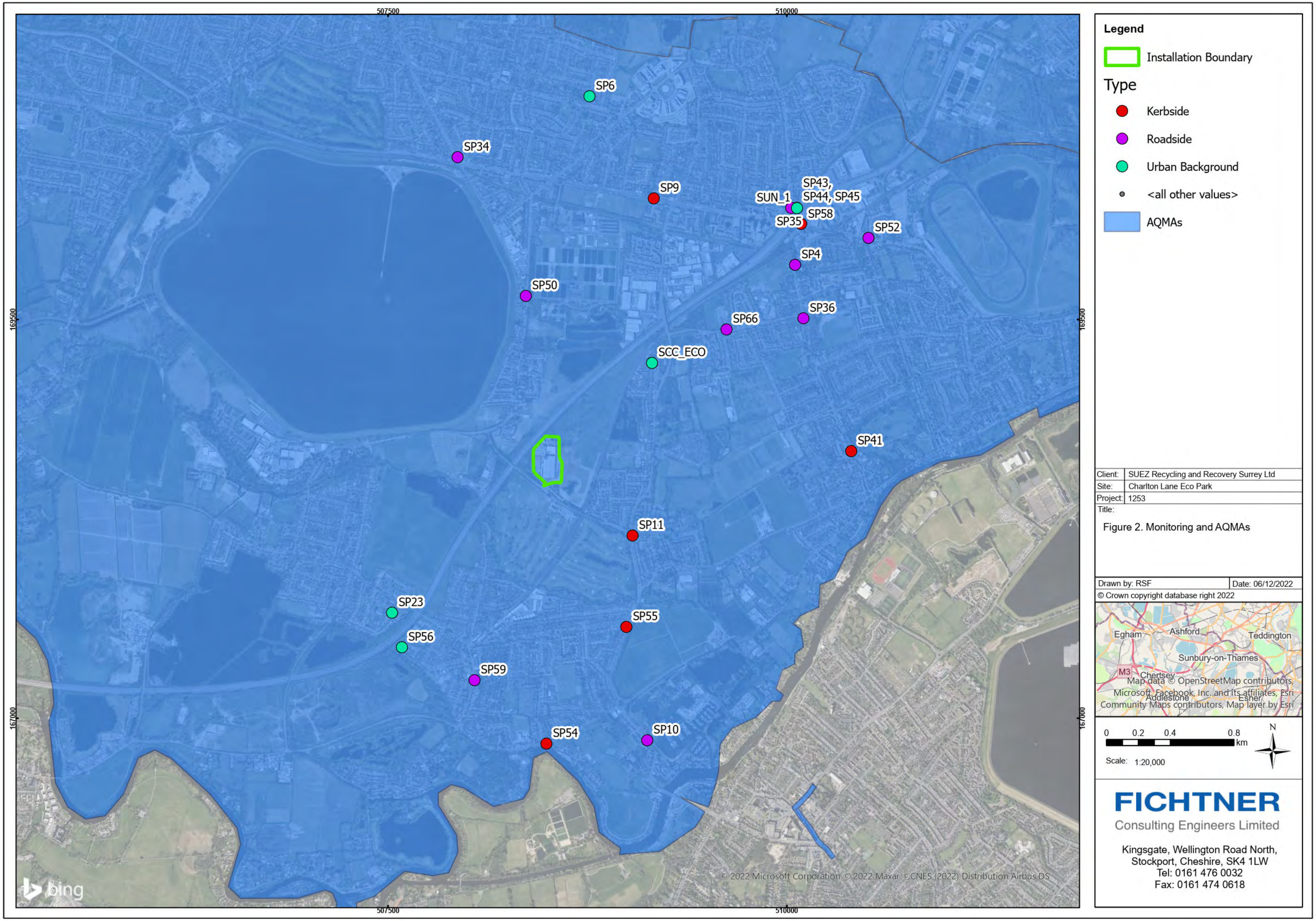
Kingsgate, Wellington Road North,
Stockport, Cheshire, SK4 1LW
Tel: 0161 476 0032
Fax: 0161 474 0618



507500
510000
169500
167000
SP6
SP34
SP9
SUN_1
SP43,
SP44, SP45
SP58
SP35
SP52
SP4
SP50
SP36
SP66
SCC_ECO
SP41
SP11
SP23
SP55
SP56
SP59
SP54
SP10
© 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) Distribution Airbus DS
bing
Legend
Installation Boundary
Type
Kerbside
Roadside
Urban Background
<all other values>
AQMAs
Client: SUEZ Recycling and Recovery Surrey Ltd
Site: Charlton Lane Eco Park
Project: 1253
Title:
Figure 2. Monitoring and AQMAs
Drawn by: RSF
Date: 06/12/2022
© Crown copyright database right 2022
Egham
Ashford
Teddington
Sunbury-on-Thames
M3
Chertsey
Addlestone
Esher
Map data © OpenStreetMap contributors, Microsoft, Facebook, Inc. and its affiliates, Esri Community Maps contributors, Map layer by Esri
0 0.2 0.4 0.8 km
N
Scale: 1:20,000
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Stockport, Cheshire, SK4 1LW
Tel: 0161 476 0032
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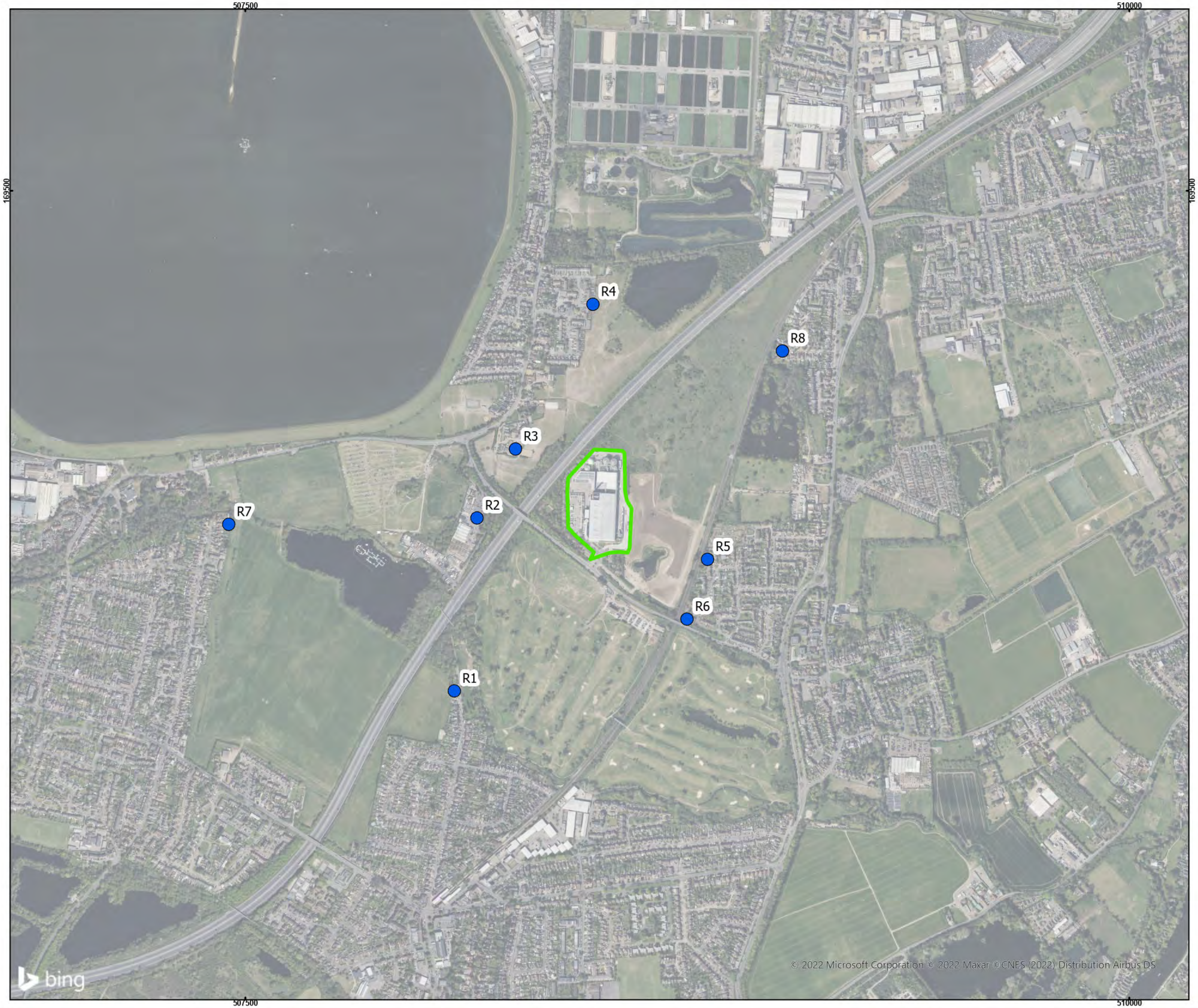


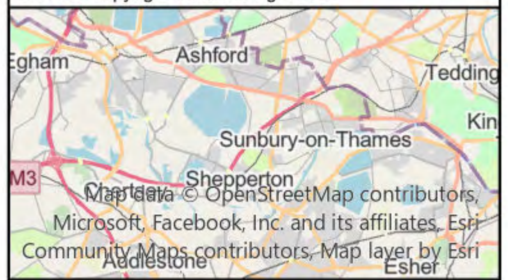
Legend

- Human Sensitive Receptors
- Installation Boundary

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253
Title:	

Figure 3. Human Receptors

Drawn by: RSF	Date: 06/12/2022



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Scale: 1:10,000

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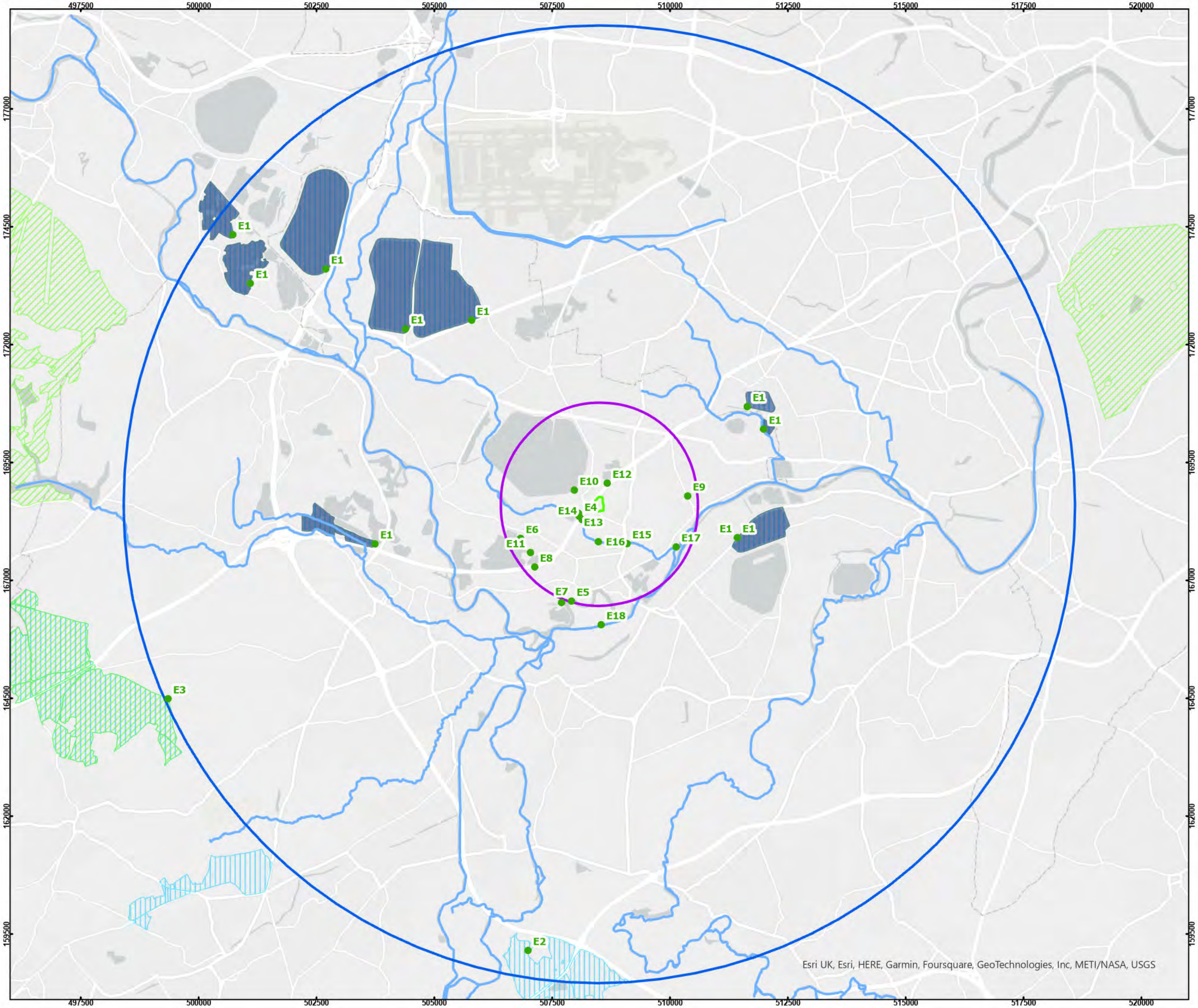


Legend

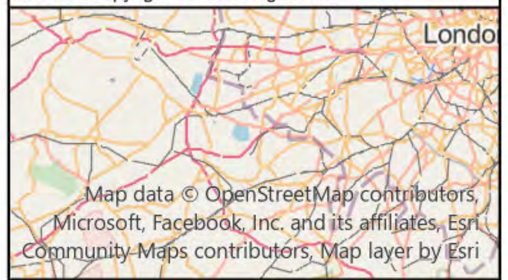
- Eco Receptor Points
- Installation Boundary
- 2km Installation Buffer
- 10km Installation Buffer
- Water Bodies
- Ramsars
- SACs
- SPAs

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253

Title:

Figure 4. Ecological Receptors

Drawn by: RSF | Date: 07/12/2022



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Scale: 1:75,000

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Stockport, Cheshire, SK4 1LW
Tel: 0161 476 0032
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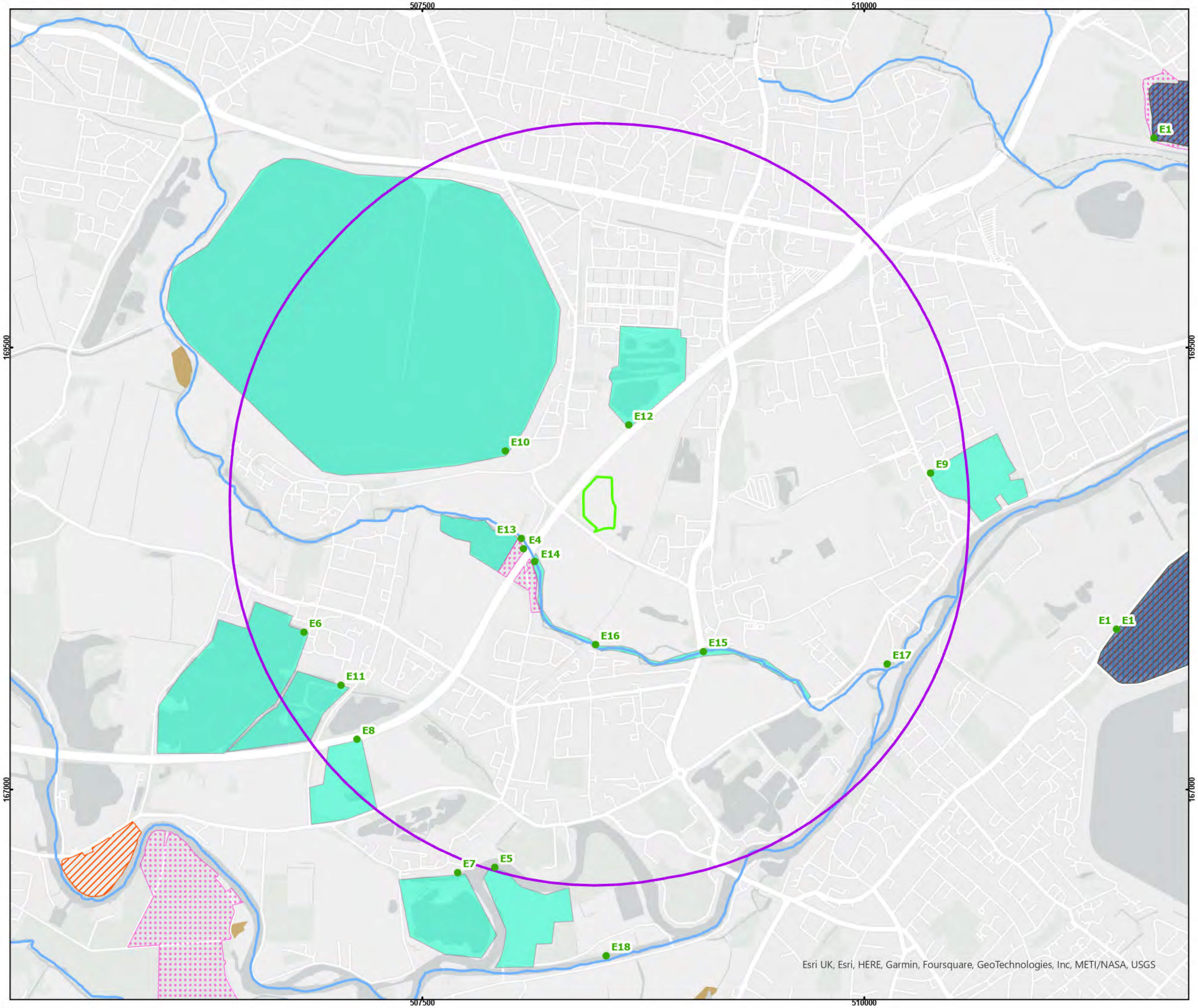
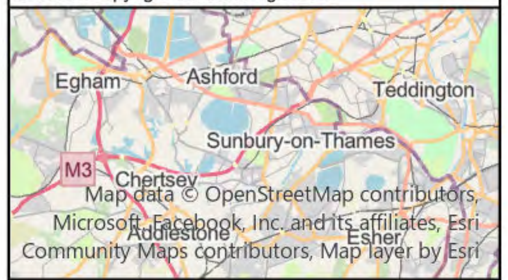


Legend

- Eco Receptor Points
- Installation Boundary
- 2km Installation Buffer
- Water Bodies
- Ramsars
- SPAs
- SSSIs
- LNRs
- LWS
- Ancient Woodlands

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253
Title:	Figure 5. Ecological Receptors - Zoomed

Drawn by: RSF | Date: 07/12/2022



0 0.2 0.4 0.8 km

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Scale: 1:20,000

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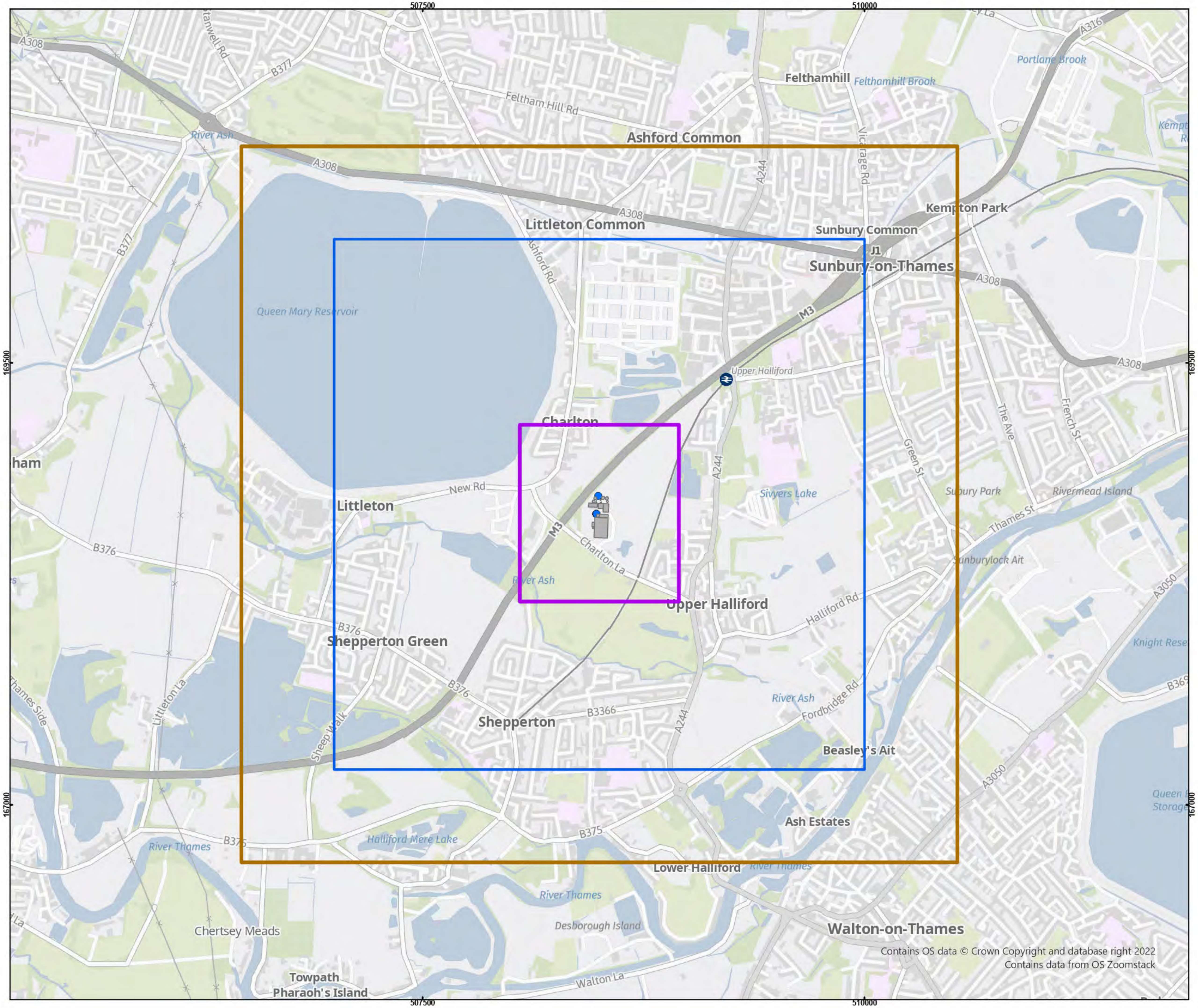


Legend

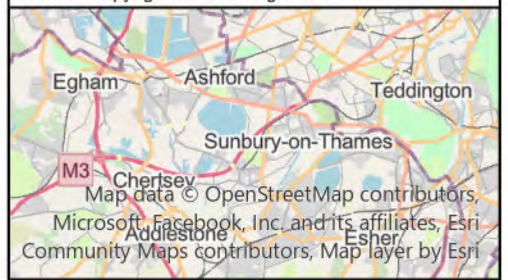
- Buildings
- Terrain and Surface Roughness Extents
- 30m resolution grid extents
- 9m resolution grid extents
- Point sources

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253

Title:

Figure 6. Model Inputs

Drawn by: RSF | Date: 06/12/2022



0 0.2 0.4 0.8 km

Scale: 1:20,000

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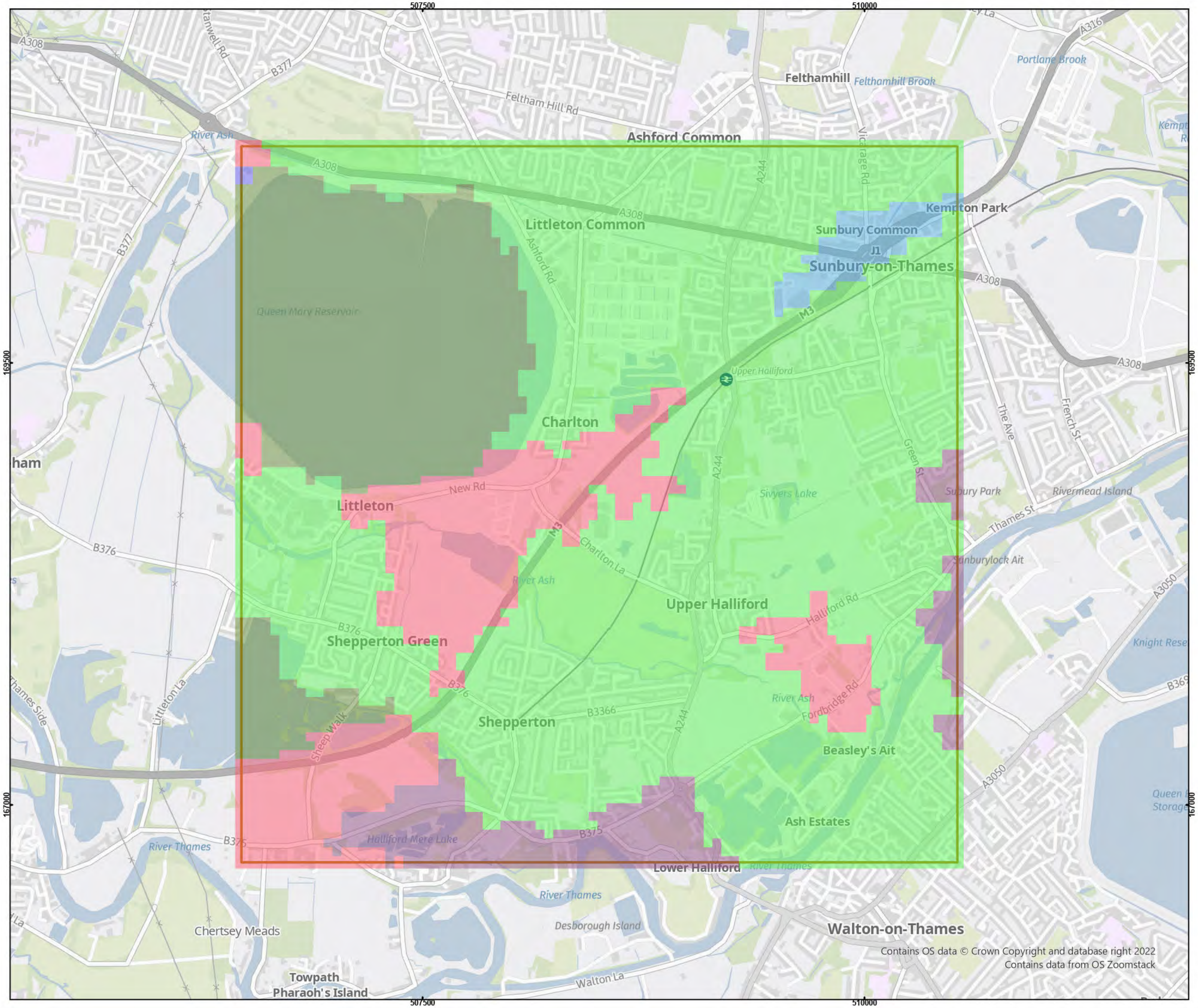


Legend

Roughness File

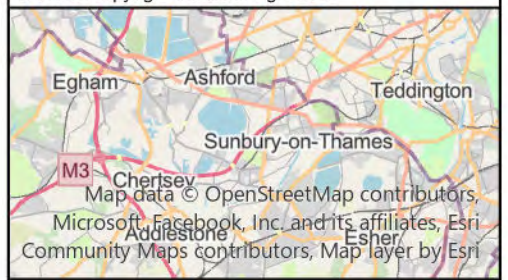
Roughness Length (m)

- 0.0001
- 0.005
- 0.03
- 0.075
- 0.5
- 0.6

Terrain and Surface Roughness Extents

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253
Title:	Figure 7. Variable Surface Roughness

Drawn by: RSF | Date: 06/12/2022



0 0.2 0.4 0.8 km

Scale: 1:20,000

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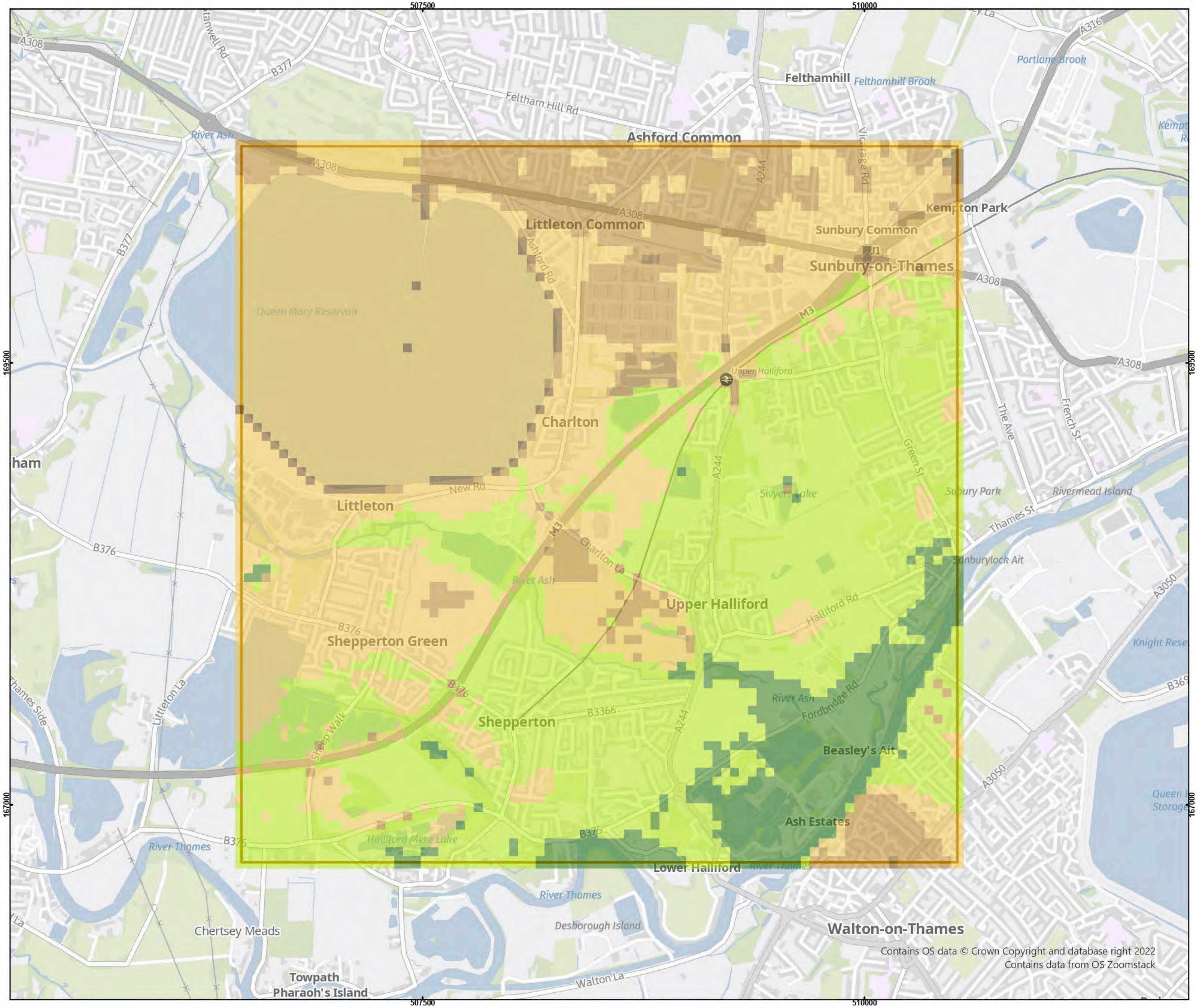

Legend

Terrain File

Elevation (m)

- 7.0 - 10.3
- 10.3 - 12.2
- 12.2 - 13.9
- 13.9 - 18.1
- >18.1
- Terrain and Surface Roughness Extents

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253
Title:	Figure 8. Terrain

Drawn by: RSF | Date: 06/12/2022

Scale: 1:20,000

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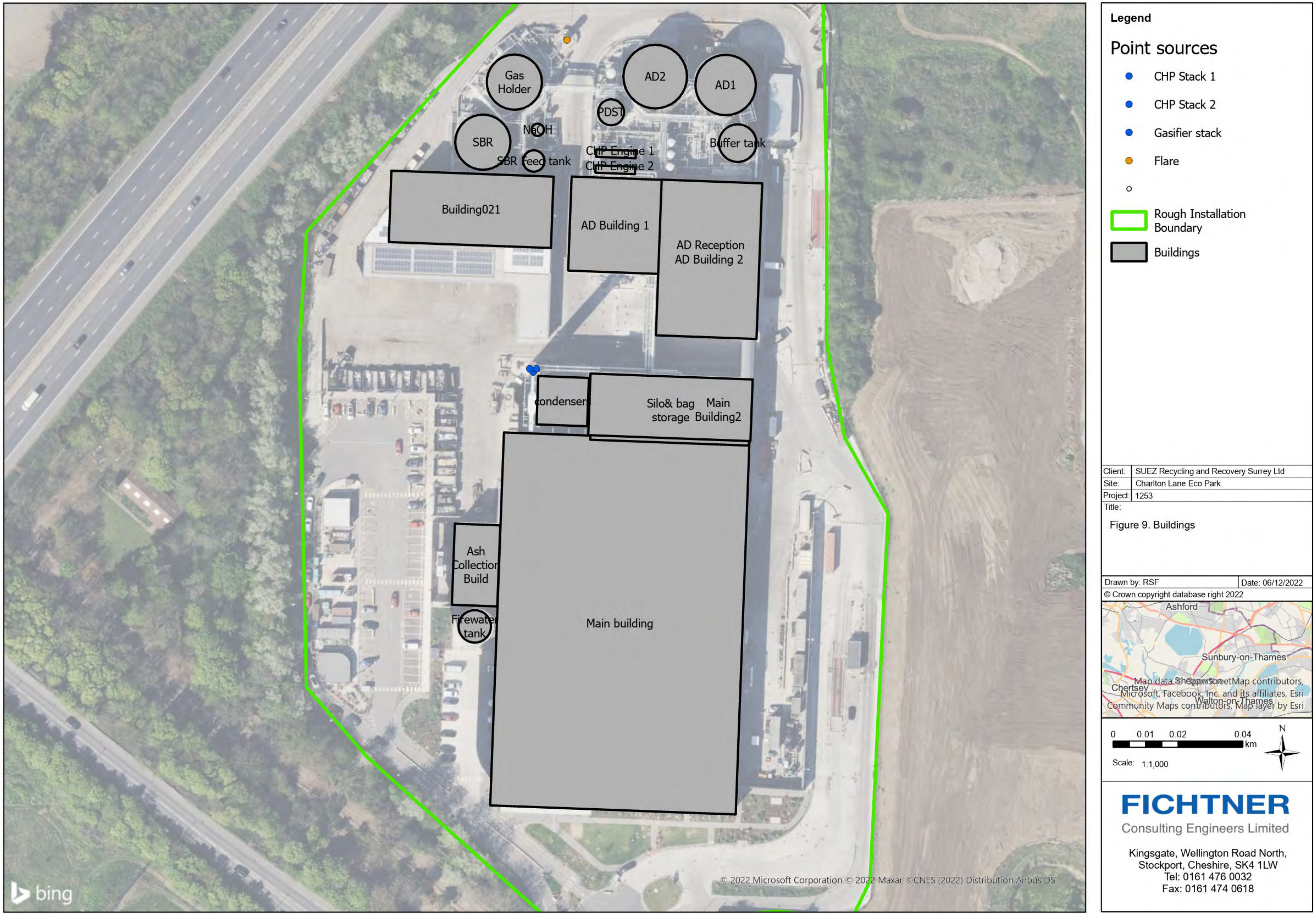

Client: SUEZ Recycling and Recovery Surrey Ltd
Site: Charlton Lane Eco Park
Project: 1253
Title:
Figure 9. Buildings

Drawn by: RSF
Date: 06/12/2022

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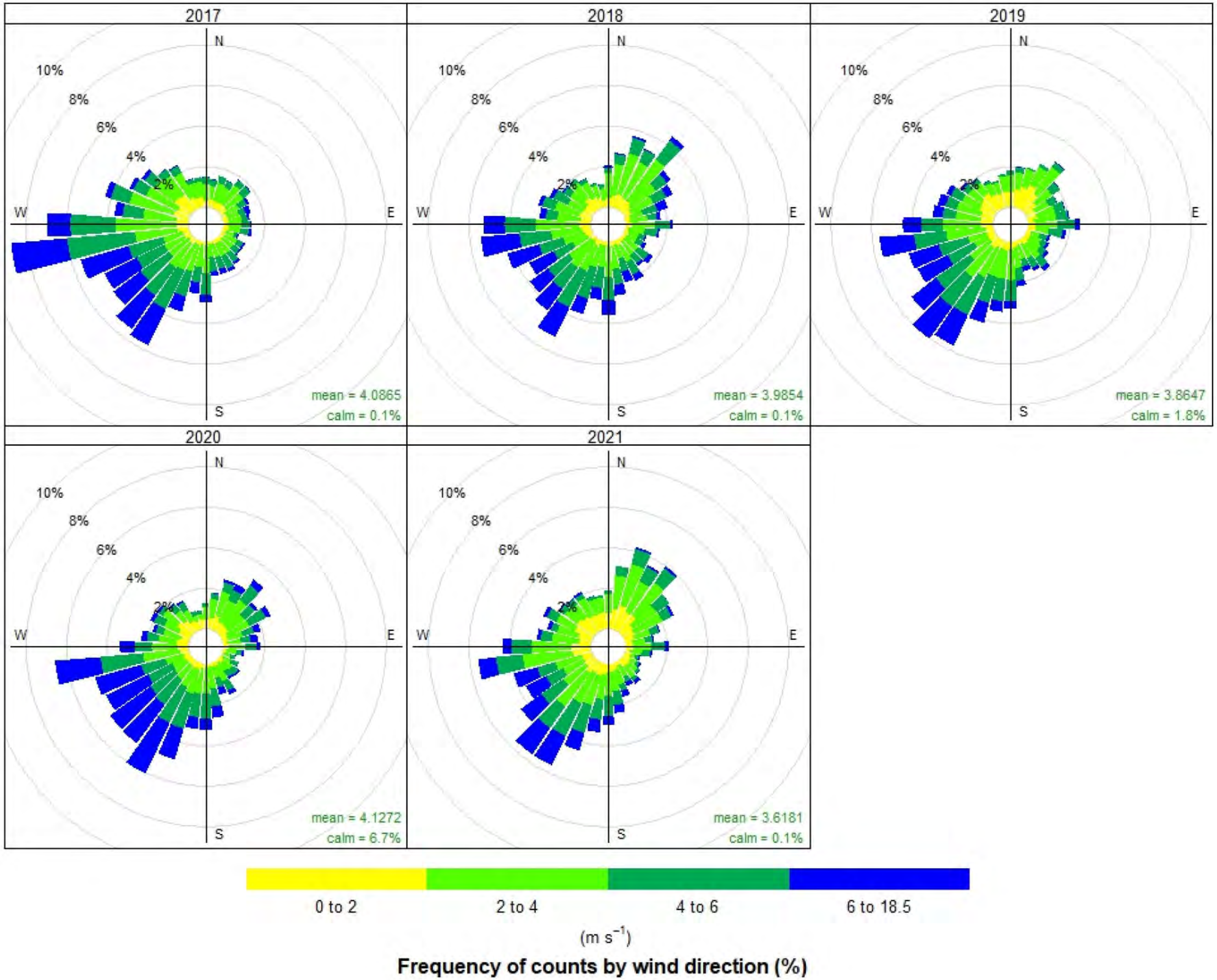
Tel: 0161 476 0032
Fax: 0161 474 0618



Legend

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	Project Name
Title:	

Figure 10. Meteorological Data (windroses)

Drawn by: RSF	Date: 07/12/2022

0 140 280 560
km
N
Scale:

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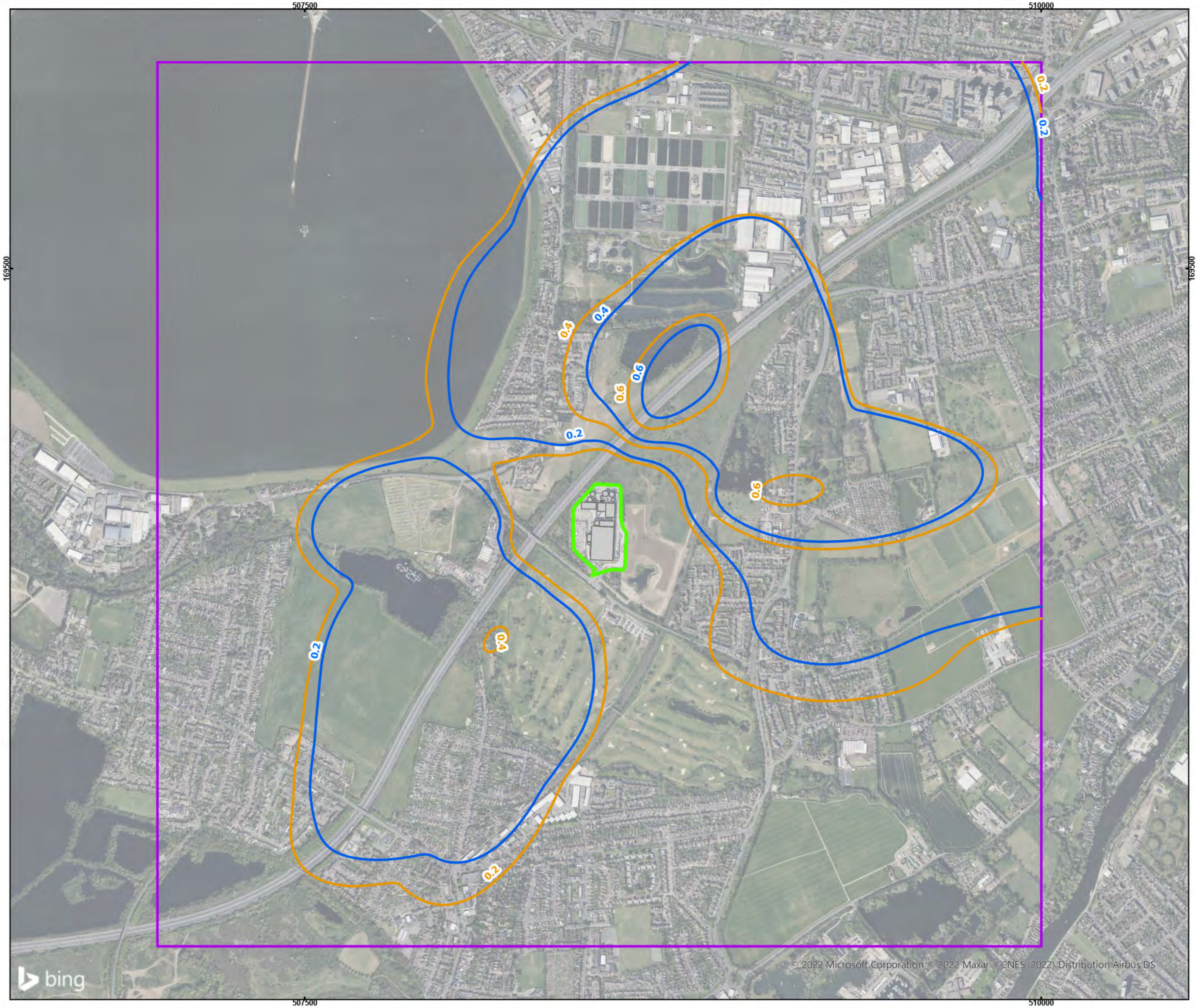


Legend

- Buildings
- Installation Boundary
- Proposed
- Permitted
- 30m resolution grid extents

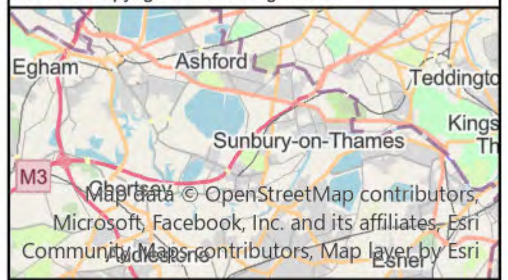
All impacts presented as % of AQAL
Assume 70% conversion of NOx to NO2

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253

Title:

Figure 11. Annual Mean Nitrogen Dioxide (% of AQAL) - Gasification Plant and Biogas Engines

Drawn by: RSF | Date: 06/12/2022



0 0.1 0.2 0.4 km

Scale: 1:12,000

N

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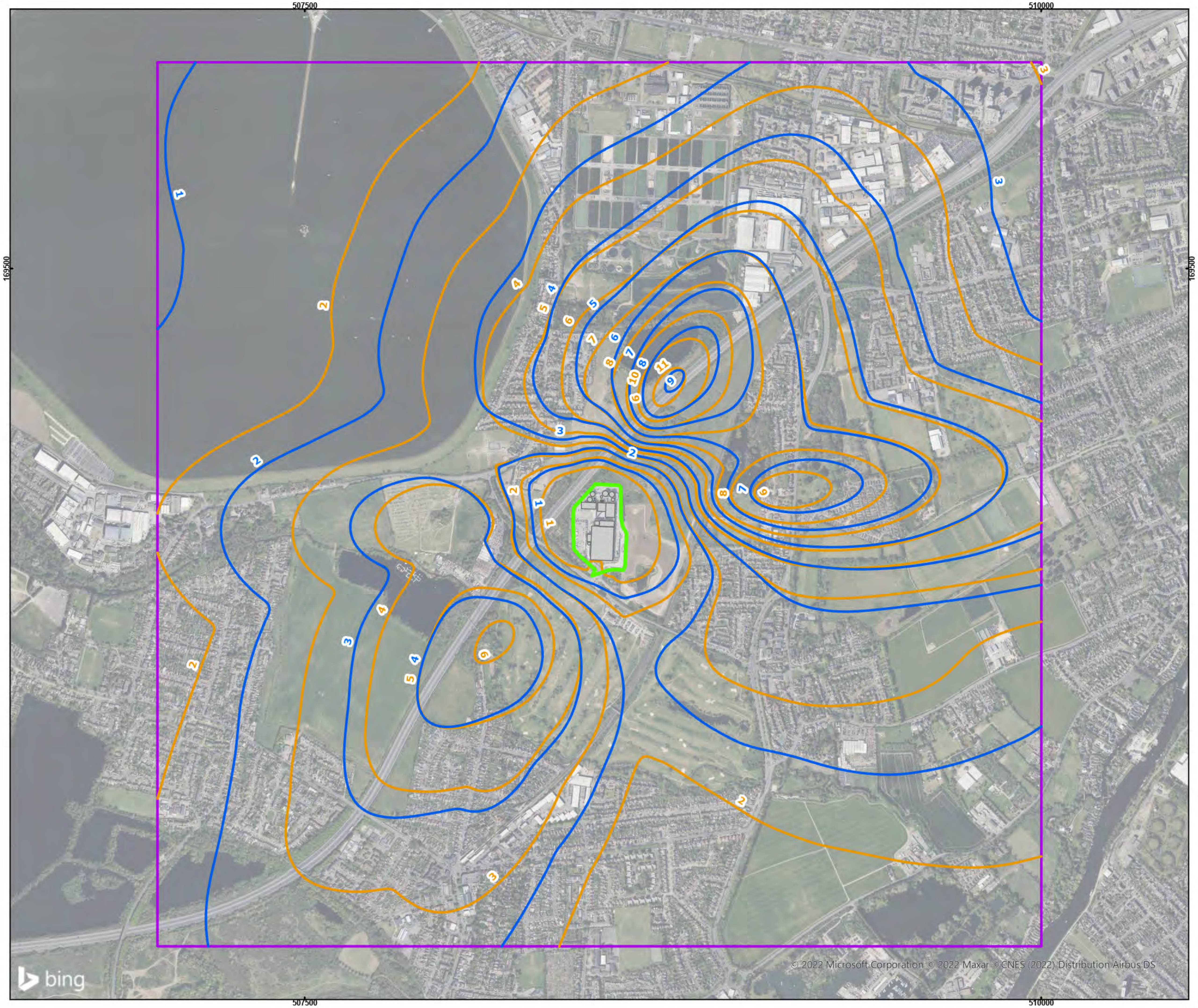


Legend

- Buildings
- Installation Boundary
- Proposed
- Permitted
- 30m resolution grid extents

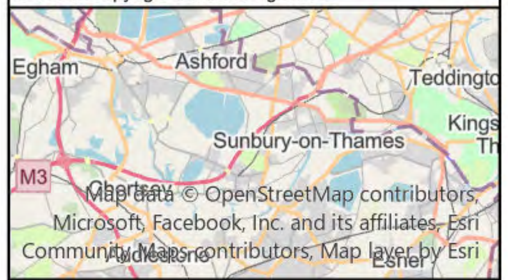
All impacts assume VOC is released at the ELV and consists of only benzene

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253

Title:

Figure 12. Annual Mean Benzene (% of AQAL) - Gasification Plant and Biogas Engines

Drawn by: RSF	Date: 06/12/2022



0 0.1 0.2 0.4 km

Scale: 1:12,000

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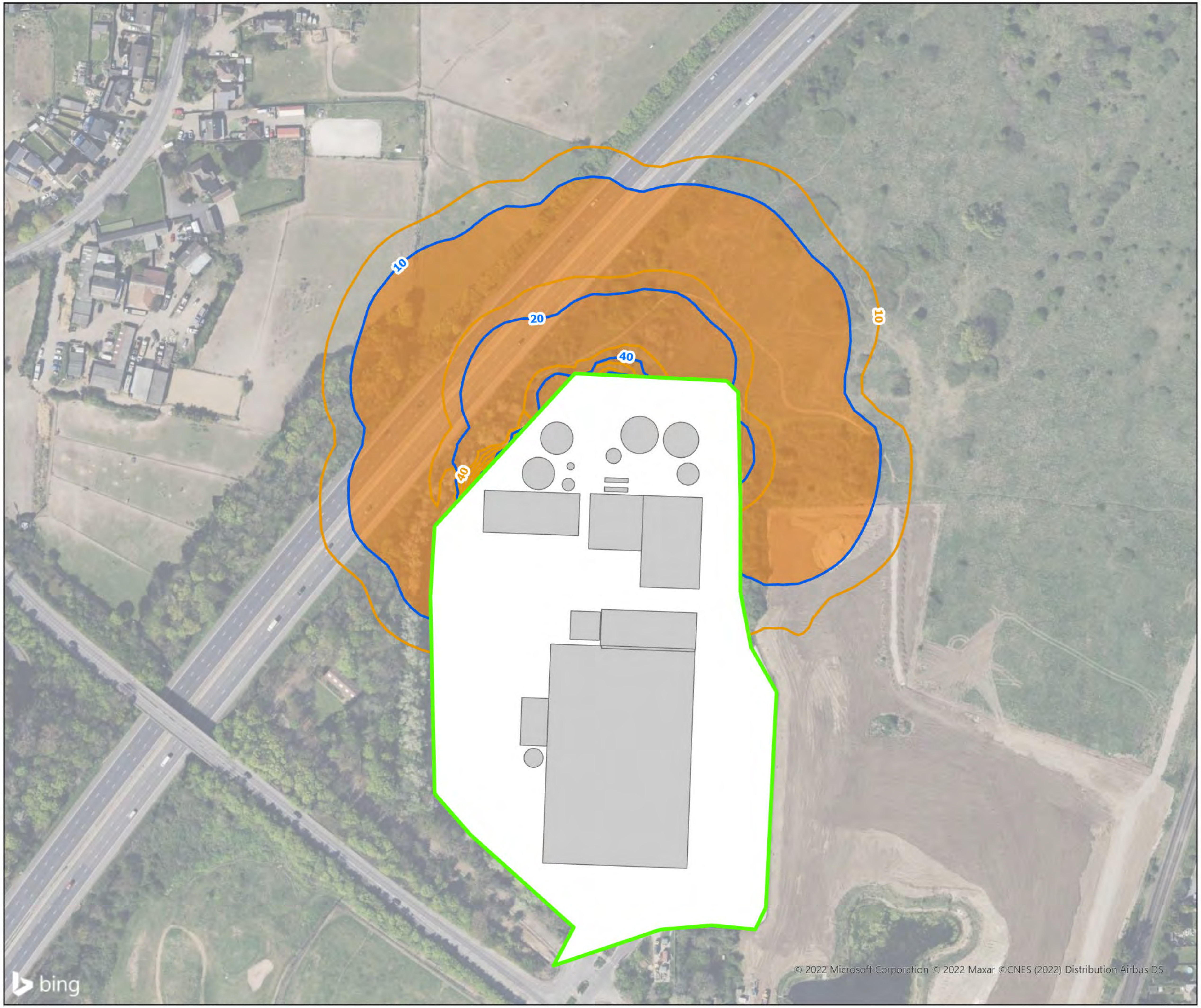


Legend

- Buildings
- Installation Boundary
- Proposed
- Permitted

Proposed

Value

- <10%
- <100%
- >100%

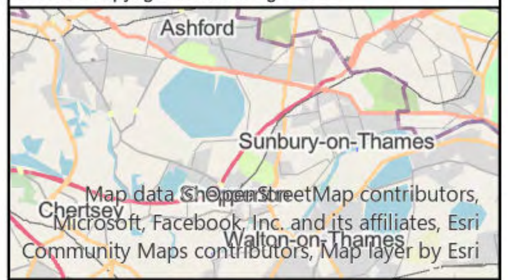
99.73%ile or 1-hour means as % of AQAL

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253

Title:

Figure 13. 1-hour Mean Sulphur Dioxide (% of AQAL) - Flare Only

Drawn by: RSF | Date: 06/12/2022



0 0.02 0.04 0.07 km

Scale: 1:1,876

N

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Legend

- Buildings
- Installation Boundary
- Proposed
- Permitted

Proposed

Value

- <10%
- <100%
- >100%

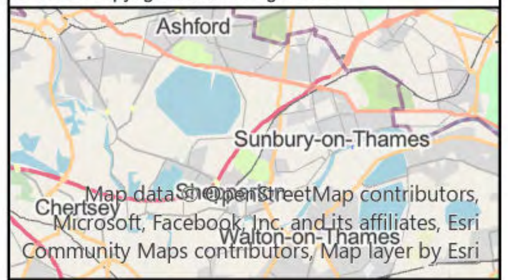
99.9 %ile of 15-minute means as a % of AQAL

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253

Title:

Figure 14. 15-min Mean Sulphur Dioxide (% of AQAL) - Flare Only

Drawn by: RSF	Date: 06/12/2022



0 0.02 0.04 0.08 km

N

Scale: 1:2,000

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Legend

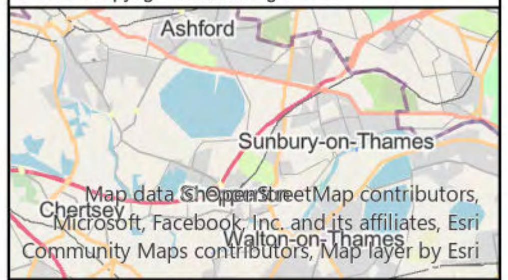
- Buildings
- Installation Boundary
- Proposed
- Permitted

Proposed_Results_ST_Value

- <10%
- <100%
- >100%

99.73%ile or 1-hour means as % of AQAL. Assumes operation of the gasification plant at the short term ELV and the flare concurrently during the worst-case weather conditions for dispersion

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253
Title:	Figure 15. 1-hour Mean Sulphur Dioxide (% of AQAL) - Flare and Gasification Plant @ ST ELV
Drawn by: RSF	Date: 06/12/2022



0 0.02 0.04 0.08 km

N

Scale: 1:2,000

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Tel: 0161 476 0032
Fax: 0161 474 0618

Legend

- Buildings
- Installation Boundary
- Proposed
- Permitted

Proposed

Value

- <10%
- <100%
- >100%

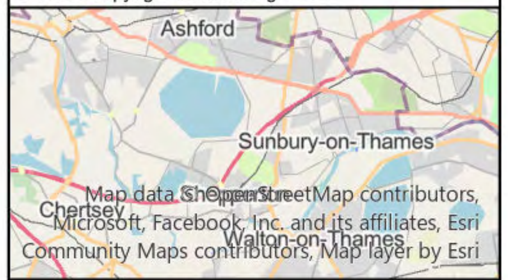
99.9%ile of 15-minute means as % of AQAL. Assumes operation of the gasification plant at the short term ELV and the flare concurrently during the worst-case weather conditions for dispersion

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253

Title:

Figure 16. 15-min Mean Sulphur Dioxide (% of AQAL) - Flare and Gasification Plant @ ST ELV

Drawn by: RSF	Date: 06/12/2022



0 0.02 0.04 0.08 km

N

Scale: 1:2,000

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Tel: 0161 476 0032
Fax: 0161 474 0618

Legend

- Buildings
- Installation Boundary
- Proposed
- 30m resolution grid extents

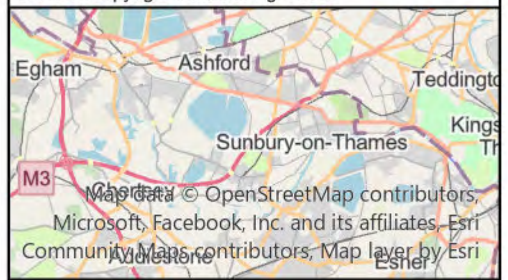
All impacts presented as OUE/m3

Client:	SUEZ Recycling and Recovery Surrey Ltd
Site:	Charlton Lane Eco Park
Project:	1253

Title:

Figure 17. 98th %ile of 1-hour Odour - Installation

Drawn by: RSF | Date: 06/12/2022



0 0.1 0.2 0.4 km

Scale: 1:12,000

N

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B APIS Critical Loads

Table 42: Nitrogen Deposition Critical Loads

ID	Site	NCL Class	kgN/hr/yr		
			Lower Critical Load	Upper Critical Load	Max. Bg.
1	South West London Water Bodies	No comparable habitat with established critical load estimate available	-	-	
2	Thames Basin Heaths	Dry Heaths	10	20	15.3
2	Thames Basin Heaths	Coniferous Woodlands	5	15	27.5
3	Thursley Ash Pirbright and Chobham Common	"Valley mires, poor fens and transition mires	10	15	15.3
3	Thursley Ash Pirbright and Chobham Common	Dry heaths	10	20	15.3
3	Thursley Ash Pirbright and Chobham Common	Northern wet heath: Erica tetralix dominated wet heath	10	20	15.3
4	Ash Link LNR	Grassland	10	15	15.1
5	Desborough Island LWS	Grassland	10	15	14.8
6	Littleton Lake LWS	Grassland	10	15	15
7	Ferris Meadows LWS	Grassland	10	15	15
8	Charlton Quarry LWS	Grassland	10	15	15.1
9	Sunbury Park LWS	Grassland	10	15	14.9
10	Queen Mary Reservoir LWS	Grassland	10	15	15.1
11	Littleton Lake - Shepperton Green Reservoir LWS	Grassland	10	15	15
12	Ashford Plant LWS	Grassland	10	15	15.1
13	River Ash: Shepperton Green LWS	Grassland	10	15	15
14	River Ash: Splash Meadow LWS	Grassland	10	15	15
15	River Ash: Gaston Bridge to Watersplash Farm LWS	Grassland	10	15	15
16	River Ash: Splash Meadow to Gaston Bridge LWS	Grassland	10	15	15
17	River Thames - Elmbridge LWS	Grassland	10	15	15
18	River Thames - Spelthorne LWS	Grassland	10	15	15

Source: APIS

Table 43: Acid Deposition Critical Loads

ID	Site	Acidity Class	Lower Critical Load Function (keq/ha/yr)			Upper Critical Load Function (keq/ha/yr)			Maximum Background (keq/ha/yr)	
			CLminN	CLmaxN	CLmaxS	CLminN	CLmaxN	CLmaxS	Nitrogen	Sulphur
1	South West London Water Bodies A	No expected negative impact on the species due to impacts on the species' broad habitat.	-	-	-	-	-	-	-	-
2	Thames Basin Heaths	Not sensitive to acidity	-	-	-	-	-	-	-	-
3	Thursley Ash Pirbright and Chobham Common	Bogs	0.321	0.532	0.211	0.321	0.676	0.355	1.33	0.19
3	Thursley Ash Pirbright and Chobham Common	Dwarf shrub heath	0.642	0.872	0.213	1.035	2.404	1.69	1.33	0.19
3	Thursley Ash Pirbright and Chobham Common	Dwarf shrub heath	0.642	0.872	0.213	1.035	2.404	1.69	1.33	0.19
4	Ash Link LNR	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
5	Desborough Island LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
6	Littleton Lake LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
7	Ferris Meadows LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
8	Charlton Quarry LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
9	Sunbury Park LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
10	Queen Mary Reservoir LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
11	Littleton Lake - Shepperton Green Reservoir LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
12	Ashford Plant LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
13	River Ash: Shepperton Green LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
14	River Ash: Splash Meadow LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
15	River Ash: Gaston Bridge to Watersplash Farm LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
16	River Ash: Splash Meadow to Gaston Bridge LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
17	River Thames - Elmbridge LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16
18	River Thames - Spelthorne LWS	Calcareous grassland	0.856	4.856	4	-	-	-	1.07	0.16

Source: APIS

C Detailed Results Tables – Permitted Facility

Table 44: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Gasifier Only – Permitted Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	24.00	0.17	0.15	0.18	0.20	0.17	0.20	0.51%	24.20	60.51%
	99.79th %ile of hourly means	µg/m³	200	48.00	1.77	1.95	2.01	1.85	2.07	2.07	1.04%	50.07	25.04%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	17.08	0.91	1.01	0.88	0.96	1.31	1.31	1.05%	18.39	14.72%
	99.73rd %ile of hourly means	µg/m³	350	17.08	2.49	2.59	2.59	2.52	2.67	2.67	0.76%	19.75	5.64%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	3.48	4.56	3.61	3.54	4.42	4.56	1.71%	21.64	8.13%
Particulates (PM_{10})	Annual mean	µg/m³	40	24.60	0.02	0.02	0.03	0.03	0.02	0.03	0.07%	24.63	61.57%
	90.4th %ile of daily means	µg/m³	50	49.20	0.09	0.08	0.09	0.10	0.09	0.10	0.20%	49.30	98.60%
Particulates ($PM_{2.5}$)	Annual mean	µg/m³	20	13.31	0.02	0.02	0.03	0.03	0.02	0.03	0.15%	13.34	66.70%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	2.42	3.62	5.27	2.89	8.00	8.00	0.08%	952.00	9.52%
	Hourly mean	µg/m³	30,000	944	12.96	22.08	13.29	15.95	25.58	25.58	0.09%	969.58	3.23%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	2.60	4.42	2.66	3.20	5.13	5.13	0.68%	6.55	0.87%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.005	0.004	0.005	0.006	0.005	0.006	0.04%	2.36	14.72%
	Hourly mean	µg/m³	160	4.70	0.52	0.88	0.53	0.64	1.03	1.03	0.64%	5.73	3.58%
Ammonia	Annual mean	µg/m³	180	1.80	0.02	0.02	0.03	0.03	0.02	0.03	0.02%	1.83	1.02%
	Hourly mean	µg/m³	2,500	3.60	2.60	4.42	2.66	3.20	5.13	5.13	0.21%	8.73	0.35%

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
VOCs (as benzene)	Annual mean	µg/m³	5	0.91	0.02	0.02	0.03	0.03	0.02	0.03	0.59%	0.94	18.79%
	Daily mean	µg/m³	30	1.82	0.24	0.29	0.29	0.30	0.37	0.37	1.23%	2.19	7.29%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.41	0.02	0.02	0.03	0.03	0.02	0.03	1.30%	0.44	19.52%
Mercury	Annual mean	ng/m³	250	2.80	0.12	0.11	0.13	0.15	0.12	0.15	0.06%	2.95	1.18%
	Hourly mean	ng/m³	7,500	5.60	12.99	22.12	13.32	15.99	25.63	25.63	0.34%	31.23	0.42%
Cadmium	Annual mean	ng/m³	5	0.14	0.12	0.11	0.13	0.15	0.12	0.15	2.93%	0.29	5.73%
	Hourly mean	ng/m³	-	0.28	12.99	22.12	13.32	15.99	25.63	25.63	-	25.91	-
PaHs	Annual mean	pg/m³	250	160.0	1.50	1.37	1.56	1.82	1.49	1.82	0.73%	161.82	64.73%
Dioxins and Furans	Annual mean	fg/m³	-	33.0	0.24	0.22	0.25	0.29	0.24	0.29	-	33.28	-
PCBs	Annual mean	ng/m³	200	0.13	0.01	0.01	0.01	0.01	0.01	0.01	0.01%	0.14	0.07%
	Hourly mean	ng/m³	6,000	0.26	1.30	2.21	1.33	1.60	2.56	2.56	0.04%	2.82	0.05%
Total metals	Annual mean	ng/m³	-	-	1.21	1.11	1.26	1.47	1.20	1.47	-	-	-
	Daily mean	ng/m³	-	-	12.00	14.67	14.55	14.98	18.40	18.40	-	-	-
	Hourly mean	ng/m³	-	-	129.92	221.23	133.22	159.88	256.35	256.35	-	-	-

Note:
Assumes continuous operation at the daily ELVs.

Table 45: Dispersion Modelling Results – PC at Point of Maximum Impact - Short-Term ELVs – Gasifier Only – Permitted Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	48.00	7.61	8.08	8.64	7.99	8.44	8.64	4.32%	56.64	28.32%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	17.08	8.55	8.98	8.88	8.94	8.80	8.98	2.57%	26.06	7.45%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	10.55	14.36	12.02	11.60	14.53	14.53	5.46%	31.61	11.88%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	7.05	10.67	16.07	8.16	23.63	23.63	0.24%	967.6	9.68%
	Hourly mean	µg/m³	30,000	944	38.40	66.44	36.91	49.43	75.68	75.68	0.25%	1019.9	3.40%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	15.42	26.67	14.82	19.84	30.38	30.38	4.05%	31.80	4.24%
Hydrogen fluoride	Hourly mean	µg/m³	160	4.70	1.03	1.78	0.99	1.32	2.03	2.03	1.27%	6.73	4.20%

Note:
Assumes continuous operation at the short term ELVs

Table 46: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Biogas Engines Only – Permitted Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	24.00	0.18	0.18	0.19	0.22	0.19	0.22	0.54%	24.22	60.54%
	99.79th %ile of hourly means	µg/m³	200	48.00	2.56	3.10	2.53	2.69	3.29	3.29	1.65%	51.29	25.65%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	17.08	2.70	2.61	2.86	2.58	4.12	4.12	3.29%	21.20	16.96%
	99.73rd %ile of hourly means	µg/m³	350	17.08	7.02	8.68	7.55	7.53	9.33	9.33	2.67%	26.41	7.55%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	15.56	15.87	12.63	11.87	20.72	20.72	7.79%	37.80	14.21%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	43.09	54.39	81.10	50.04	107.87	107.87	1.08%	1051.87	10.52%
	Hourly mean	µg/m³	30,000	944	12.96	22.08	13.29	15.95	25.58	25.58	0.09%	969.58	3.23%
VOCs (as benzene)	Annual mean	µg/m³	5	0.91	0.84	0.84	0.91	1.02	0.90	1.02	20.49%	1.93	38.69%
	Daily mean	µg/m³	30	1.82	9.36	12.36	13.43	9.76	19.25	19.25	64.16%	21.07	70.23%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.41	0.84	0.84	0.91	1.02	0.90	1.02	45.53%	1.43	63.75%
Note: Assumes continuous operation at the ELVs.													

Table 47: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Flare Only – Permitted Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m^3	40	24.00	0.65	0.53	0.67	0.67	0.60	0.67	1.7%	24.67	61.7%
	99.79th %ile of hourly means	µg/m^3	200	48.00	24.12	24.97	24.32	23.61	25.54	25.54	12.8%	73.54	36.8%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m^3	350	17.08	180.65	183.01	181.42	174.34	186.92	186.92	53.4%	204.00	58.3%
	99.9th %ile of 15 min. means	µg/m^3	266	17.08	203.58	202.77	204.10	194.03	209.50	209.50	78.8%	226.58	85.2%
Carbon monoxide	8 hour running mean	µg/m^3	10,000	944	26.71	24.02	23.67	21.19	21.80	26.71	0.27%	970.71	9.71%
	Hourly mean	µg/m^3	30,000	944	74.45	62.90	38.97	25.82	25.92	74.45	0.25%	1018.45	3.39%
VOCs (as benzene)	Annual mean	µg/m^3	5	0.91	0.06	0.05	0.06	0.06	0.06	0.06	1.28%	0.97	19.48%
	Daily mean	µg/m^3	30	1.82	3.60	3.03	3.22	3.44	3.77	3.77	12.57%	5.59	18.64%
VOCs (as 1,3-butadiene)	Annual mean	µg/m^3	2.25	0.41	0.06	0.05	0.06	0.06	0.06	0.06	2.84%	0.47	21.06%

Note:
Assumes continuous operation at the ELVs.
When calculating annual mean impacts it is assumed that the flare is operational for 10% of the year.
Maximum outside of the installation boundary.

Table 48: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Gasifier and Biogas Engines – Permitted Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	24.00	0.25	0.22	0.25	0.30	0.24	0.30	0.74%	24.30	60.74%
	99.79th %ile of hourly means	µg/m³	200	48.00	2.55	2.68	2.85	2.66	2.78	2.85	1.43%	50.85	25.43%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	17.08	1.95	2.26	1.92	2.12	2.72	2.72	2.18%	19.80	15.84%
	99.73rd %ile of hourly means	µg/m³	350	17.08	5.36	5.63	5.57	5.60	5.52	5.63	1.61%	22.71	6.49%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	6.58	9.01	7.50	7.19	9.07	9.07	3.41%	26.15	9.83%
Particulates (PM_{10})	Annual mean	µg/m³	40	24.60	0.02	0.02	0.02	0.03	0.02	0.03	0.07%	24.63	61.57%
	90.4th %ile of daily means	µg/m³	50	49.20	0.02	0.02	0.02	0.03	0.02	0.03	0.05%	49.23	98.45%
Particulates ($PM_{2.5}$)	Annual mean	µg/m³	20	13.31	0.02	0.02	0.02	0.03	0.02	0.03	0.13%	13.34	66.68%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	13.20	19.52	29.47	14.92	43.10	43.10	0.43%	987.10	9.87%
	Hourly mean	µg/m³	30,000	944	69.96	122.10	67.80	90.50	137.86	137.86	0.46%	1081.86	3.61%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	2.08	3.63	2.01	2.69	4.10	4.10	0.55%	5.52	0.74%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.004	0.004	0.005	0.005	0.004	0.005	0.03%	2.36	14.72%
	Hourly mean	µg/m³	160	4.70	0.42	0.73	0.40	0.54	0.82	0.82	0.51%	5.52	3.45%
Ammonia	Annual mean	µg/m³	180	1.80	0.02	0.02	0.02	0.03	0.02	0.03	0.01%	1.83	1.01%
	Hourly mean	µg/m³	2,500	3.60	2.08	3.63	2.01	2.69	4.10	4.10	0.16%	7.70	0.31%
	Annual mean	µg/m³	5	0.91	0.47	0.42	0.48	0.57	0.46	0.57	11.31%	1.48	29.51%

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
VOCs (as benzene)	Daily mean	µg/m³	30	1.82	4.53	5.65	5.47	5.75	7.00	7.00	23.34%	8.82	29.41%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.41	0.47	0.42	0.48	0.57	0.46	0.57	25.13%	0.98	43.35%
Mercury	Annual mean	ng/m³	250	2.80	0.11	0.10	0.11	0.13	0.11	0.13	0.05%	2.93	1.17%
	Hourly mean	ng/m³	7,500	5.60	10.39	18.14	10.07	13.44	20.48	20.48	0.27%	26.08	0.35%
Cadmium	Annual mean	ng/m³	5	0.14	0.11	0.10	0.11	0.13	0.11	0.13	2.63%	0.27	5.43%
	Hourly mean	ng/m³	-	0.28	10.39	18.14	10.07	13.44	20.48	20.48	-	20.76	-
PaHs	Annual mean	pg/m³	250	160	1.36	1.22	1.40	1.63	1.32	1.63	0.65%	161.63	64.65%
Dioxins and Furans	Annual mean	fg/m³	-	32.99	0.22	0.20	0.23	0.26	0.21	0.26	-	33.25	-
PCBs	Annual mean	ng/m³	200	0.13	0.01	0.01	0.01	0.01	0.01	0.01	0.01%	0.14	0.07%
	Hourly mean	ng/m³	6,000	0.26	1.04	1.81	1.01	1.34	2.05	2.05	0.03%	2.31	0.04%
Total metals	Annual mean	ng/m³	-	-	1.10	0.99	1.13	1.32	1.06	1.32	-	-	-
	Daily mean	ng/m³	-	-	10.54	13.15	12.73	13.40	16.30	16.30	-	-	-
	Hourly mean	ng/m³	-	-	103.94	181.39	100.73	134.45	204.81	204.81	-	-	-

Note:
Assumes continuous operation at the daily ELVs.

Table 49: Dispersion Modelling Results – PC at Point of Maximum Impact – Gasifier Operating at Short Term ELV – Biogas Engines Operating at ELV – Permitted Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	48.00	7.36	7.74	8.24	7.70	8.03	8.24	4.12%	56.24	28.12%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	17.08	12.16	12.77	12.63	12.69	12.51	12.77	3.65%	29.85	8.53%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	14.92	20.43	17.01	16.31	20.56	20.56	7.73%	37.64	14.15%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	17.28	25.56	38.58	19.54	56.43	56.43	0.56%	1000.3	10.00%
	Hourly mean	µg/m³	30,000	944	69.96	122.10	67.80	90.50	137.86	137.86	0.46%	1081.9	3.61%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	12.47	21.77	12.09	16.13	24.58	24.58	3.28%	26.00	3.47%
Hydrogen fluoride	Hourly mean	µg/m³	160	4.70	0.83	1.45	0.81	1.08	1.64	1.64	1.02%	6.34	3.96%

Note:
Assumes continuous operation of the gasifier at the short term ELVs, and the biogas engines at the ELV.

Table 50: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Gasification Plant and Flare – Permitted Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	99.79^{th} %ile of hourly means	µg/m³	200	48.00	24.12	24.97	24.32	23.61	25.54	25.54	12.8%	73.54	36.8%
Sulphur dioxide	99.73^{rd} %ile of hourly means	µg/m³	350	17.08	180.65	183.01	181.42	174.34	186.92	186.92	53.4%	204.00	58.3%
	99.9^{th} %ile of 15 min. means	µg/m³	266	17.08	203.58	202.77	204.10	194.03	209.50	209.50	78.8%	226.58	85.2%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	26.71	24.02	23.67	21.19	24.50	26.71	0.27%	970.71	9.71%
	Hourly mean	µg/m³	30,000	944	74.45	67.16	40.69	48.59	77.39	77.39	0.26%	1021.39	3.40%

Note:
Assumes continuous operation of the gasification plant at the half-hourly ELVs, no biogas engines and flare at the ELV.
Maximum outside the installation boundary.

Table 51: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Gasification Plant, Biogas Engines and Flare Annual Mean – Permitted Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	24.00	0.65	0.54	0.67	0.68	0.60	0.68	1.69%	24.68	61.69%
VOCs (as benzene)	Annual mean	µg/m³	5	0.91	0.52	0.47	0.54	0.63	0.51	0.63	12.55%	1.54	30.75%
VOCs (as 1-3-butadiene)	Annual mean	µg/m³	2.5	0.41	0.52	0.47	0.54	0.63	0.51	0.63	27.88%	1.04	46.10%

Note:
Assumes continuous operation of the gasification plant at the daily ELVs, biogas engines operating for 90% of the time and the flare for 10% of the time.
Maximum outside the installation boundary.

Table 52: Impact at Ecological Sites – Gasifier and Biogas engines – Permitted Facility

ID	Site	Oxides of nitrogen (µg/m³)		Sulphur dioxide (µg/m³)	Hydrogen fluoride (µg/m³)		Ammonia (µg/m³)
		Annual mean	Daily mean	Annual mean	Weekly mean	Daily mean	Annual mean
E1		0.066	0.519	0.050	0.003	0.006	0.004
E2		0.016	0.660	0.012	0.001	0.008	0.001
E3		0.010	0.134	0.007	0.001	0.002	0.001
E4		0.200	2.617	0.151	0.016	0.032	0.012
E5		0.080	1.031	0.060	0.006	0.013	0.005
E6		0.061	0.855	0.046	0.006	0.011	0.004
E7		0.082	1.465	0.062	0.006	0.018	0.005
E8		0.089	0.985	0.067	0.007	0.012	0.006
E9		0.175	0.982	0.132	0.005	0.012	0.011
E10		0.111	2.427	0.083	0.007	0.030	0.007
E11		0.077	1.038	0.058	0.006	0.013	0.005
E12		0.184	2.732	0.138	0.019	0.034	0.011
E13		0.189	2.667	0.142	0.018	0.033	0.012
E14		0.236	3.184	0.178	0.019	0.039	0.015
E15		0.094	1.371	0.071	0.005	0.017	0.006
E16		0.105	1.742	0.079	0.007	0.022	0.007
E17		0.108	0.671	0.081	0.004	0.008	0.007
E18		0.042	0.698	0.032	0.002	0.009	0.003

Table 53: Impact at Ecological Sites – Gasifier and Biogas engines – Permitted Facility

ID	Site	Oxides of nitrogen (% CL)		Sulphur dioxide (% CL)	Hydrogen fluoride (% CL)		Ammonia (% CL)
		Annual mean	Daily mean	Annual mean	Weekly mean	Daily mean	Annual mean
E1		0.22%	0.69%	0.25%	0.51%	0.13%	0.14%
E2		0.05%	0.88%	0.06%	0.19%	0.16%	0.03%
E3		0.03%	0.18%	0.07%	0.18%	0.03%	0.06%
E4		0.67%	3.49%	0.75%	3.25%	0.65%	0.41%
E5		0.27%	1.37%	0.30%	1.29%	0.26%	0.17%
E6		0.20%	1.14%	0.23%	1.16%	0.21%	0.13%
E7		0.27%	1.95%	0.31%	1.28%	0.36%	0.17%
E8		0.30%	1.31%	0.34%	1.33%	0.24%	0.18%
E9		0.58%	1.31%	0.66%	1.08%	0.24%	0.36%
E10		0.37%	3.24%	0.42%	1.49%	0.60%	0.23%
E11		0.26%	1.38%	0.29%	1.15%	0.26%	0.16%
E12		1.47%	4.08%	1.66%	3.67%	0.76%	0.91%
E13		0.63%	3.56%	0.71%	3.50%	0.66%	0.39%
E14		0.79%	4.25%	0.89%	3.88%	0.79%	0.49%
E15		0.31%	1.83%	0.36%	1.07%	0.34%	0.19%
E16		0.35%	2.32%	0.40%	1.32%	0.43%	0.22%
E17		0.29%	1.05%	0.32%	0.74%	0.20%	0.18%
E18		0.14%	0.93%	0.16%	0.41%	0.17%	0.09%

Table 54: Annual Mean PC used for Deposition Analysis – Gasifier and Biogas engines – Permitted Facility

ID	Site	Annual mean PC (ng/m³)			
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia
E1		46.2	49.7	4.1	4.1
E2		11.0	11.9	1.0	1.0
E3		6.9	7.4	0.6	0.6
E4		140.3	151.0	12.4	12.4
E5		56.1	60.4	5.0	5.0
E6		42.7	45.9	3.8	3.8
E7		57.7	62.1	5.1	5.1
E8		62.6	67.4	5.5	5.5
E9		122.2	131.5	10.8	10.8
E10		77.4	83.3	6.9	6.9
E11		54.2	58.4	4.8	4.8
E12		307.9	331.3	27.3	27.3
E13		132.1	142.2	11.7	11.7
E14		165.4	178.0	14.6	14.6
E15		66.0	71.0	5.8	5.8
E16		73.6	79.2	6.5	6.5
E17		60.1	64.7	5.3	5.3
E18		29.4	31.7	2.6	2.6

Table 55: Deposition Calculation - Grassland – Gasifier and Biogas Engines – Permitted Facility

ID	Site	Deposition (kg/ha/yr)				Total N Deposition (kg/ha/yr)	Acid Deposition (keq/ha/yr)	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
E1		0.007	0.094	0.063	0.021	0.028	0.002	0.008
E2		0.002	0.022	0.015	0.005	0.007	0.000	0.002
E3		0.001	0.014	0.009	0.003	0.004	0.000	0.001
E4		0.020	0.286	0.191	0.065	0.085	0.006	0.023
E5		0.008	0.114	0.076	0.026	0.034	0.002	0.009
E6		0.006	0.087	0.058	0.020	0.026	0.002	0.007
E7		0.008	0.118	0.078	0.027	0.035	0.002	0.010
E8		0.009	0.128	0.085	0.029	0.038	0.003	0.010
E9		0.018	0.249	0.166	0.056	0.074	0.005	0.020
E10		0.011	0.158	0.105	0.036	0.047	0.003	0.013
E11		0.008	0.110	0.074	0.025	0.033	0.002	0.009
E12		0.044	0.627	0.418	0.142	0.186	0.013	0.051
E13		0.019	0.269	0.179	0.061	0.080	0.006	0.022
E14		0.024	0.337	0.225	0.076	0.100	0.007	0.027
E15		0.010	0.134	0.090	0.030	0.040	0.003	0.011
E16		0.011	0.150	0.100	0.034	0.044	0.003	0.012
E17		0.009	0.122	0.082	0.028	0.036	0.003	0.010
E18		0.004	0.060	0.040	0.014	0.018	0.001	0.005

Table 56: Deposition Calculation - Woodland – Gasifier and Biogas Engines – Permitted Facility

ID	Site	Deposition (kg/ha/yr)				Total N Deposition (kg/ha/yr)	Acid Deposition (keq/ha/yr)	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
E1		0.013	0.188	0.151	0.032	0.045	0.003	0.016
E2		0.003	0.045	0.036	0.008	0.011	0.001	0.004
E3		0.002	0.028	0.022	0.005	0.007	0.000	0.002
E4		0.040	0.571	0.457	0.097	0.137	0.010	0.049
E5		0.016	0.229	0.183	0.039	0.055	0.004	0.019
E6		0.012	0.174	0.139	0.029	0.042	0.003	0.015
E7		0.017	0.235	0.188	0.040	0.056	0.004	0.020
E8		0.018	0.255	0.204	0.043	0.061	0.004	0.022
E9		0.035	0.498	0.398	0.084	0.120	0.009	0.042
E10		0.022	0.315	0.252	0.053	0.076	0.005	0.027
E11		0.016	0.221	0.177	0.037	0.053	0.004	0.019
E12		0.089	1.254	1.004	0.212	0.301	0.022	0.107
E13		0.038	0.538	0.431	0.091	0.129	0.009	0.046
E14		0.048	0.674	0.539	0.114	0.162	0.012	0.057
E15		0.019	0.269	0.215	0.046	0.065	0.005	0.023
E16		0.021	0.300	0.240	0.051	0.072	0.005	0.025
E17		0.017	0.245	0.196	0.042	0.059	0.004	0.021
E18		0.008	0.120	0.096	0.020	0.029	0.002	0.010

Table 57: Nitrogen Deposition – Gasifier and Biogas Engines – Permitted Facility

ID	Site	NCL Class	Lower CL (kgN/ha/yr)	Upper CL (kgN/ha/yr)	Background (kgN/ha/yr)	PC (kgN/ha/yr)	Process Contribution		Predicted Environmental Concentration	
							% of Lower CL or Bg	% of Upper CL	% of Lower CL	% of Upper CL
E1	South West London Water Bodies A	No comparable habitat with established critical load estimate available	-	-	-	0.028	-	-	-	-
E2	Thames Basin Heaths	Dry Heaths	10	20	15.3	0.007	0.07%	0.03%	15.3	153.1%
E2	Thames Basin Heaths	Coniferous Woodlands	5	15	27.5	0.011	0.22%	0.07%	27.5	550.2%
E3	Thursley Ash Pirbright and Chobham Common	"Valley mires, poor fens and transition mires	10	15	15.3	0.004	0.04%	0.03%	15.3	153.0%
E3	Thursley Ash Pirbright and Chobham Common	Dry heaths	10	20	15.3	0.004	0.04%	0.02%	15.3	153.0%
E3	Thursley Ash Pirbright and Chobham Common	Northern wet heath: Erica tetralix dominated wet heath	10	20	15.3	0.004	0.04%	0.02%	15.3	153.0%
E4	Ash Link LNR	Grassland	10	15	15.1	0.085	0.85%	0.56%	15.2	151.8%
E5	Desborough Island LWS	Grassland	10	15	14.8	0.034	0.34%	0.23%	14.8	148.3%
E6	Littleton Lake LWS	Grassland	10	15	15	0.026	0.26%	0.17%	15.0	150.3%
E7	Ferris Meadows LWS	Grassland	10	15	15	0.035	0.35%	0.23%	15.0	150.3%
E8	Charlton Quarry LWS	Grassland	10	15	15.1	0.038	0.38%	0.25%	15.1	151.4%
E9	Sunbury Park LWS	Grassland	10	15	14.9	0.074	0.74%	0.49%	15.0	149.7%
E10	Queen Mary Reservoir LWS	Grassland	10	15	15.1	0.047	0.47%	0.31%	15.1	151.5%
E11	Littleton Lake - Shepperton Green Reservoir LWS	Grassland	10	15	15	0.033	0.33%	0.22%	15.0	150.3%
E12	Ashford Plant LWS	Grassland	10	15	15.1	0.186	1.86%	1.24%	15.3	152.9%
E13	River Ash: Shepperton Green LWS	Grassland	10	15	15	0.080	0.80%	0.53%	15.1	150.8%
E14	River Ash: Splash Meadow LWS	Grassland	10	15	15	0.100	1.00%	0.67%	15.1	151.0%
E15	River Ash: Gaston Bridge to Watersplash Farm LWS	Grassland	10	15	15	0.040	0.40%	0.27%	15.0	150.4%
E16	River Ash: Splash Meadow to Gaston Bridge LWS	Grassland	10	15	15	0.044	0.44%	0.30%	15.0	150.4%
E17	River Thames - Elmbridge LWS	Grassland	10	15	15	0.036	0.36%	0.24%	15.0	150.4%
E18	River Thames - Spelthorne LWS	Grassland	10	15	15	0.018	0.18%	0.12%	15.0	150.2%

Table 58: Acid Deposition – Gasifier and Biogas engines – Permitted Facility

ID	Site	Acidity class	Min CL (CLmaxN)	Max CL (CLmaxN)	Background		Process Contribution				Predicted Environmental Concentration	
					N (kgN/ha/yr)	S (kgS/ha/yr)	N (kg/ha/yr)	S (kgS/ha/yr)	% of Lower CL	% of Upper CL	% of Lower CL	% of Upper CL
1	South West London Water Bodies A	No expected negative impact on the species due to impacts on the species' broad habitat.	-	-	-	-	0.002	0.008	-	-	-	-
2	Thames Basin Heaths	Not sensitive to acidity	-	-	-	-	0.000	0.002	-	-	-	-
3	Thursley Ash Pirbright and Chobham Common	Bogs	0.532	0.676	1.33	0.19	0.000	0.001	0.3%	0.2%	286.0%	225.1%
3	Thursley Ash Pirbright and Chobham Common	Dwarf shrub heath	0.872	2.404	1.33	0.19	0.000	0.001	0.2%	0.1%	174.5%	63.3%
3	Thursley Ash Pirbright and Chobham Common	Dwarf shrub heath	0.872	2.404	1.33	0.19	0.000	0.001	0.2%	0.1%	174.5%	63.3%
4	Ash Link LNR	Calcareous grassland	4.856	-	1.07	0.16	0.006	0.023	0.6%	-	25.9%	-
5	Desborough Island LWS	Calcareous grassland	4.856	-	1.07	0.16	0.002	0.009	0.2%	-	25.6%	-
6	Littleton Lake LWS	Calcareous grassland	4.856	-	1.07	0.16	0.002	0.007	0.2%	-	25.5%	-
7	Ferris Meadows LWS	Calcareous grassland	4.856	-	1.07	0.16	0.002	0.010	0.2%	-	25.6%	-
8	Charlton Quarry LWS	Calcareous grassland	4.856	-	1.07	0.16	0.003	0.010	0.3%	-	25.6%	-
9	Sunbury Park LWS	Calcareous grassland	4.856	-	1.07	0.16	0.005	0.020	0.5%	-	25.9%	-
10	Queen Mary Reservoir LWS	Calcareous grassland	4.856	-	1.07	0.16	0.003	0.013	0.3%	-	25.7%	-
11	Littleton Lake - Shepperton Green Reservoir LWS	Calcareous grassland	4.856	-	1.07	0.16	0.002	0.009	0.2%	-	25.6%	-
12	Ashford Plant LWS	Calcareous grassland	4.856	-	1.07	0.16	0.013	0.051	1.3%	-	26.7%	-
13	River Ash: Shepperton Green LWS	Calcareous grassland	4.856	-	1.07	0.16	0.006	0.022	0.6%	-	25.9%	-
14	River Ash: Splash Meadow LWS	Calcareous grassland	4.856	-	1.07	0.16	0.007	0.027	0.7%	-	26.0%	-
15	River Ash: Gaston Bridge to Watersplash Farm LWS	Calcareous grassland	4.856	-	1.07	0.16	0.003	0.011	0.3%	-	25.6%	-
16	River Ash: Splash Meadow to Gaston Bridge LWS	Calcareous grassland	4.856	-	1.07	0.16	0.003	0.012	0.3%	-	25.6%	-
17	River Thames - Elmbridge LWS	Calcareous grassland	4.856	-	1.07	0.16	0.003	0.010	0.3%	-	25.6%	-
18	River Thames - Spelthorne LWS	Calcareous grassland	4.856	-	1.07	0.16	0.001	0.005	0.1%	-	25.5%	-

D Detailed Results Tables – Proposed Facility

Table 59: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Gasifier Only – Proposed Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	24.00	0.19	0.17	0.19	0.22	0.18	0.22	0.56%	24.22	60.56%
	99.79th %ile of hourly means	µg/m³	200	48.00	1.90	2.02	2.16	2.00	2.11	2.16	1.08%	50.16	25.08%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	17.08	0.78	0.90	0.77	0.84	1.08	1.08	0.87%	18.16	14.53%
	99.73rd %ile of hourly means	µg/m³	350	17.08	2.14	2.24	2.22	2.24	2.20	2.24	0.64%	19.32	5.52%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	2.64	3.59	3.01	2.90	3.63	3.63	1.37%	20.71	7.79%
Particulates (PM_{10})	Annual mean	µg/m³	40	24.60	0.01	0.01	0.01	0.02	0.01	0.02	0.04%	24.62	61.54%
	90.4th %ile of daily means	µg/m³	50	49.20	0.05	0.04	0.05	0.06	0.05	0.06	0.11%	49.26	98.51%
Particulates ($PM_{2.5}$)	Annual mean	µg/m³	20	13.31	0.01	0.01	0.01	0.02	0.01	0.02	0.08%	13.33	66.63%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	2.35	3.56	5.36	2.72	7.88	7.88	0.08%	951.88	9.52%
	Hourly mean	µg/m³	30,000	944	12.80	22.15	12.30	16.48	25.23	25.23	0.08%	969.23	3.23%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	2.06	3.56	1.98	2.65	4.05	4.05	0.54%	5.47	0.73%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.003	0.002	0.003	0.003	0.003	0.003	0.02%	2.35	14.71%
	Hourly mean	µg/m³	160	4.70	0.26	0.44	0.25	0.33	0.51	0.51	0.32%	5.21	3.25%
Ammonia	Annual mean	µg/m³	180	1.80	0.03	0.02	0.03	0.03	0.03	0.03	0.02%	1.83	1.02%
	Hourly mean	µg/m³	2,500	3.60	2.57	4.45	2.47	3.31	5.06	5.06	0.20%	8.66	0.35%

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
VOCs (as benzene)	Annual mean	µg/m³	5	0.91	0.03	0.02	0.03	0.03	0.03	0.03	0.64%	0.94	18.84%
	Daily mean	µg/m³	30	1.82	0.26	0.32	0.31	0.33	0.40	0.40	1.32%	2.22	7.39%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.41	0.03	0.02	0.03	0.03	0.03	0.03	1.42%	0.44	19.65%
Mercury	Annual mean	ng/m³	250	2.80	0.05	0.05	0.05	0.06	0.05	0.06	0.03%	2.86	1.15%
	Hourly mean	ng/m³	7,500	5.60	5.14	8.89	4.94	6.61	10.13	10.13	0.14%	15.73	0.21%
Cadmium	Annual mean	ng/m³	5	0.14	0.05	0.05	0.05	0.06	0.05	0.06	1.28%	0.20	4.08%
	Hourly mean	ng/m³	-	0.28	5.14	8.89	4.94	6.61	10.13	10.13	-	10.41	-
PaHs	Annual mean	pg/m³	250	160	1.65	1.49	1.70	1.99	1.61	1.99	0.80%	161.99	64.80%
Dioxins and Furans	Annual mean	fg/m³	-	32.99	0.21	0.19	0.22	0.26	0.21	0.26	-	33.25	-
PCBs	Annual mean	ng/m³	200	0.13	0.01	0.01	0.01	0.02	0.01	0.02	0.01%	0.14	0.07%
	Hourly mean	ng/m³	6,000	0.26	1.28	2.22	1.23	1.65	2.53	2.53	0.04%	2.79	0.05%
Total metals	Annual mean	ng/m³	-	-	0.80	0.72	0.82	0.96	0.78	0.96	-	-	-
	Daily mean	ng/m³	-	-	7.68	9.57	9.34	9.75	11.92	11.92	-	-	-
	Hourly mean	ng/m³	-	-	77.08	133.36	74.09	99.22	151.90	151.90	-	-	-

Note:
Assumes continuous operation at the daily ELVs.

Table 60: Dispersion Modelling Results – PC at Point of Maximum Impact - Short-Term ELVs – Gasifier Only – Proposed Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	48	7.61	8.08	8.64	7.99	8.44	8.64	4.32%	56.64	28.32%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	17.08	10.69	11.22	11.10	11.18	11.00	11.22	3.21%	28.30	8.09%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	13.19	17.96	15.03	14.50	18.17	18.17	6.83%	35.25	13.25%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	7.05	10.67	16.07	8.16	23.63	23.63	0.24%	967.6	9.68%
	Hourly mean	µg/m³	30,000	944	38.40	66.44	36.91	49.43	75.68	75.68	0.25%	1019.9	3.40%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	9.64	16.67	9.26	12.40	18.99	18.99	2.53%	20.41	2.72%
Hydrogen fluoride	Hourly mean	µg/m³	160	4.7	0.64	1.11	0.62	0.83	1.27	1.27	0.79%	5.97	3.73%

Note:
Assumes continuous operation at the short term ELVs

Table 61: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Biogas engine Only – Proposed Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	24.00	0.13	0.13	0.14	0.16	0.14	0.16	0.40%	24.16	60.40%
	99.79th %ile of hourly means	µg/m³	200	48.00	1.58	1.88	1.76	1.84	2.27	2.27	1.14%	50.27	25.14%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	17.08	2.15	1.81	1.96	1.89	2.64	2.64	2.11%	19.72	15.78%
	99.73rd %ile of hourly means	µg/m³	350	17.08	4.78	5.44	5.39	5.10	6.03	6.03	1.72%	23.11	6.60%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	8.85	10.82	7.78	7.80	12.14	12.14	4.56%	29.22	10.99%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	27.22	36.08	49.68	29.30	74.58	74.58	0.75%	1018.58	10.19%
	Hourly mean	µg/m³	30,000	944	12.80	22.15	12.30	16.48	25.23	25.23	0.08%	969.23	3.23%
VOCs (as benzene)	Annual mean	µg/m³	5	0.91	0.64	0.60	0.67	0.77	0.66	0.77	15.41%	1.68	33.61%
	Daily mean	µg/m³	30	1.82	6.62	8.20	8.13	7.64	12.73	12.73	42.44%	14.55	48.51%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.41	0.64	0.60	0.67	0.77	0.66	0.77	34.25%	1.18	52.47%

Note:
Assumes continuous operation at the ELVs.

Table 62: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Flare Only – Proposed Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	24.00	0.56	0.45	0.58	0.61	0.49	0.61	1.53%	24.61	61.53%
	99.79th %ile of hourly means	µg/m³	200	48.00	21.88	21.76	21.82	21.60	21.78	21.88	10.94%	69.88	34.94%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	17.08	163.24	162.68	162.92	160.40	163.18	163.24	46.64%	180.32	51.52%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	172.32	172.64	172.36	170.61	171.89	172.64	64.90%	189.72	71.32%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	19.05	18.97	18.97	19.99	19.39	19.99	0.20%	963.99	9.64%
	Hourly mean	µg/m³	30,000	944	21.72	21.44	21.41	21.73	21.45	21.73	0.07%	965.73	3.22%
VOCs (as benzene)	Annual mean	µg/m³	5	0.91	0.05	0.04	0.06	0.06	0.05	0.06	1.18%	0.97	19.38%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.41	0.05	0.04	0.06	0.06	0.05	0.06	2.62%	0.47	20.84%

Note:
Assumes continuous operation at the ELVs.
Maximum outside the installation boundary.

Table 63: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Gasifier and Biogas engines – Proposed Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	24.00	0.23	0.20	0.23	0.27	0.22	0.27	0.68%	24.27	60.68%
	99.79th %ile of hourly means	µg/m³	200	48.00	2.38	2.50	2.43	2.45	2.39	2.50	1.25%	50.50	25.25%
Sulphur dioxide	99.18th %ile of daily means	µg/m³	125	17.08	1.43	1.80	1.54	1.72	1.89	1.89	1.51%	18.97	15.18%
	99.73rd %ile of hourly means	µg/m³	350	17.08	4.24	4.57	4.27	4.47	4.33	4.57	1.31%	21.65	6.19%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	4.89	5.58	5.40	5.15	5.36	5.58	2.10%	22.66	8.52%
Particulates (PM_{10})	Annual mean	µg/m³	40	24.60	0.01	0.01	0.01	0.01	0.01	0.01	0.03%	24.61	61.53%
	90.4th %ile of daily means	µg/m³	50	49.20	0.04	0.03	0.04	0.05	0.04	0.05	0.10%	49.25	98.50%
Particulates ($PM_{2.5}$)	Annual mean	µg/m³	20	13.31	0.01	0.01	0.01	0.01	0.01	0.01	0.07%	13.32	66.62%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	11.42	12.65	20.95	11.43	27.72	27.72	0.28%	971.7	9.72%
	Hourly mean	µg/m³	30,000	944	44.96	81.91	37.21	64.19	88.85	88.85	0.30%	1032.9	3.44%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	1.30	2.37	1.08	1.86	2.57	2.57	0.34%	3.99	0.53%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.002	0.002	0.002	0.003	0.002	0.003	0.02%	2.35	14.70%
	Hourly mean	µg/m³	160	4.70	0.16	0.30	0.13	0.23	0.32	0.32	0.20%	5.02	3.14%
Ammonia	Annual mean	µg/m³	180	1.80	0.02	0.02	0.02	0.03	0.02	0.03	0.01%	1.83	1.01%
	Hourly mean	µg/m³	2,500	3.60	1.63	2.96	1.35	2.32	3.21	3.21	0.13%	6.81	0.27%
	Annual mean	µg/m³	5	0.91	0.38	0.33	0.38	0.45	0.36	0.45	9.08%	1.36	27.28%

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
VOCs (as benzene)	Daily mean	µg/m³	30	1.82	3.57	4.36	3.76	4.29	5.26	5.26	17.54%	7.08	23.60%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.41	0.38	0.33	0.38	0.45	0.36	0.45	20.17%	0.86	38.39%
Mercury	Annual mean	ng/m³	250	2.80	0.04	0.04	0.04	0.05	0.04	0.05	0.02%	2.85	1.14%
	Hourly mean	ng/m³	7,500	5.60	3.25	5.93	2.69	4.64	6.43	6.43	0.09%	12.03	0.16%
Cadmium	Annual mean	ng/m³	5	0.14	0.04	0.04	0.04	0.05	0.04	0.05	1.06%	0.19	3.86%
	Hourly mean	ng/m³	-	0.28	3.25	5.93	2.69	4.64	6.43	6.43	-	6.71	-
PaHs	Annual mean	pg/m³	250	160	1.38	1.20	1.39	1.64	1.29	1.64	0.66%	161.64	64.66%
Dioxins and Furans	Annual mean	fg/m³	-	32.99	0.18	0.16	0.18	0.21	0.17	0.21	-	33.20	-
PCBs	Annual mean	ng/m³	200	0.13	0.01	0.01	0.01	0.01	0.01	0.01	0.01%	0.14	0.07%
	Hourly mean	ng/m³	6,000	0.26	0.81	1.48	0.67	1.16	1.61	1.61	0.03%	1.86	0.03%
Total metals	Annual mean	ng/m³	-	-	0.67	0.58	0.67	0.79	0.62	0.79	-	-	-
	Daily mean	ng/m³	-	-	6.24	7.61	6.57	7.49	9.19	9.19	-	-	-
	Hourly mean	ng/m³	-	-	48.79	88.90	40.38	69.66	96.42	96.42	-	-	-

Note:
Assumes continuous operation at the daily ELVs.

Table 64: Dispersion Modelling Results – PC at Point of Maximum Impact – Gasifier Operating at Short Term ELV – Biogas engines Operating at ELV – Proposed Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	48.00	7.19	7.54	7.32	7.39	7.22	7.54	3.77%	55.54	27.77%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	17.08	11.24	12.13	11.33	11.86	11.49	12.13	3.46%	29.21	8.34%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	12.98	14.79	14.33	13.66	14.22	14.79	5.56%	31.87	11.98%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	15.53	17.21	28.50	15.54	37.71	37.71	0.38%	981.7	9.82%
	Hourly mean	µg/m³	30,000	944	44.96	81.91	37.21	64.19	88.85	88.85	0.30%	1032.9	3.44%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	9.76	17.78	8.08	13.93	19.28	19.28	2.57%	20.70	2.76%
Hydrogen fluoride	Hourly mean	µg/m³	160	4.70	0.65	1.19	0.54	0.93	1.29	1.29	0.80%	5.99	3.74%

Note:
Assumes continuous operation of the gasifier at the short term ELVs, and the biogas engines at the ELV.

Table 65: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Gasification Plant and Flare – Proposed Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	99.79th %ile of hourly means	µg/m³	200	48.00	21.88	21.76	21.82	21.60	21.78	21.88	10.94%	69.88	34.94%
Sulphur dioxide	99.73rd %ile of hourly means	µg/m³	350	17.08	163.24	162.68	162.92	160.40	163.18	163.24	46.64%	180.32	51.52%
	99.9th %ile of 15 min. means	µg/m³	266	17.08	172.32	172.64	172.36	170.61	171.89	172.64	64.90%	189.72	71.32%
Carbon monoxide	8 hour running mean	µg/m³	10,000	944	19.05	18.97	18.97	19.99	23.87	23.87	0.24%	967.87	9.68%
	Hourly mean	µg/m³	30,000	944	38.84	66.96	37.18	49.93	75.93	75.93	0.25%	1019.93	3.40%

Note:
Assumes continuous operation of the gasification plant at the half-hourly ELVs, no biogas engines and flare at the ELV.
Maximum outside the installation boundary.

Table 66: Dispersion Modelling Results – PC at Point of Maximum Impact - Daily ELVs – Gasification Plant, Biogas engines and Flare Annual Mean – Proposed Facility

Pollutant	Quantity	Units	AQAL	Bg Conc.	2016	2017	2018	2019	2020	Max	Max as % of AQAL	PEC	PEC as % of AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	24.00	0.56	0.45	0.58	0.62	0.49	0.62	1.54%	24.62	61.54%
VOCs (as benzene)	Annual mean	µg/m³	5	0.91	0.42	0.37	0.43	0.50	0.40	0.50	10.06%	1.41	28.26%
VOCs (as 1-3-butadiene)	Annual mean	µg/m³	2.5	0.41	0.42	0.37	0.43	0.50	0.40	0.50	22.35%	0.91	40.58%

Note:
Assumes continuous operation of the gasification plant at the daily ELVs, biogas engines operating for 90% of the time and the flare for 10% of the time.
Maximum outside the installation boundary.

Table 67: Receptor Results - Gasification Plant, Gas Engines and Flare Annual Mean – Proposed Facility

Receptor		Gasification Plant and Biogas engine – 100% of the time		Gasification Plant – 100%, Biogas engine 90% and Flare 10% of the time		Change in impact	
		PC	% AQAL	PC	% AQAL	PC	% AQAL
R1	Charlton Road South	0.14	0.34%	0.14	0.36%	0.009	0.02%
R2	Nutty Lane	0.08	0.20%	0.09	0.23%	0.012	0.03%
R3	Charlton Road North	0.03	0.08%	0.05	0.12%	0.017	0.04%
R4	Hetherington Road	0.17	0.41%	0.18	0.46%	0.017	0.04%
R5	Hawthorn Way North	0.04	0.11%	0.05	0.13%	0.007	0.02%
R6	Hawthorn Way South	0.06	0.14%	0.06	0.15%	0.005	0.01%
R7	Watersplash Road	0.07	0.18%	0.08	0.20%	0.004	0.01%
R8	Birch Grove	0.20	0.51%	0.22	0.56%	0.018	0.05%

Table 68: Impact at Ecological Sites – Gasifier and Biogas engines – Proposed Facility

ID	Site	Oxides of nitrogen (µg/m³)		Sulphur dioxide (µg/m³)	Hydrogen fluoride (µg/m³)		Ammonia (µg/m³)
		Annual mean	Daily mean	Annual mean	Weekly mean	Daily mean	Annual mean
E1		0.063	0.471	0.041	0.001	0.003	0.004
E2		0.016	0.664	0.011	0.001	0.004	0.001
E3		0.010	0.136	0.007	0.001	0.001	0.001
E4		0.177	2.427	0.115	0.008	0.016	0.012
E5		0.073	0.988	0.048	0.003	0.007	0.005
E6		0.059	0.853	0.038	0.003	0.006	0.004
E7		0.076	1.433	0.049	0.003	0.010	0.005
E8		0.084	0.976	0.054	0.003	0.007	0.006
E9		0.169	0.962	0.110	0.003	0.006	0.011
E10		0.097	2.375	0.063	0.004	0.016	0.007
E11		0.073	0.994	0.048	0.003	0.007	0.005
E12		0.397	2.851	0.258	0.009	0.019	0.027
E13		0.168	2.509	0.110	0.009	0.017	0.011
E14		0.206	2.874	0.134	0.009	0.019	0.014
E15		0.087	1.369	0.057	0.003	0.009	0.006
E16		0.097	1.598	0.063	0.004	0.011	0.007
E17		0.080	0.803	0.052	0.002	0.005	0.005
E18		0.038	0.573	0.025	0.001	0.004	0.003

Table 69: Impact at Ecological Sites – Gasifier and Biogas engines – Proposed Facility

ID	Site	Oxides of nitrogen (% CL)		Sulphur dioxide (% CL)	Hydrogen fluoride (% CL)		Ammonia (% CL)
		Annual mean	Daily mean	Annual mean	Weekly mean	Daily mean	Annual mean
E1		0.21%	0.63%	0.21%	0.26%	0.06%	0.14%
E2		0.05%	0.89%	0.05%	0.11%	0.09%	0.04%
E3		0.03%	0.18%	0.07%	0.10%	0.02%	0.07%
E4		0.59%	3.24%	0.58%	1.60%	0.33%	0.40%
E5		0.24%	1.32%	0.24%	0.67%	0.13%	0.16%
E6		0.20%	1.14%	0.19%	0.66%	0.12%	0.13%
E7		0.25%	1.91%	0.25%	0.67%	0.19%	0.17%
E8		0.28%	1.30%	0.27%	0.68%	0.13%	0.19%
E9		0.56%	1.28%	0.55%	0.57%	0.13%	0.38%
E10		0.32%	3.17%	0.32%	0.70%	0.32%	0.22%
E11		0.24%	1.33%	0.24%	0.61%	0.13%	0.16%
E12		1.32%	3.80%	1.29%	1.70%	0.38%	0.89%
E13		0.56%	3.35%	0.55%	1.82%	0.34%	0.38%
E14		0.69%	3.83%	0.67%	1.82%	0.39%	0.46%
E15		0.29%	1.82%	0.28%	0.59%	0.18%	0.20%
E16		0.32%	2.13%	0.31%	0.71%	0.22%	0.22%
E17		0.27%	1.07%	0.26%	0.38%	0.11%	0.18%
E18		0.13%	0.76%	0.12%	0.20%	0.08%	0.09%

Table 70: Annual Mean PC used for Deposition Analysis – Gasifier and Biogas engines – Proposed Facility

ID	Site	Annual mean PC (ng/m^3)			
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia
E1		44.2	41.1	3.4	4.3
E2		11.4	10.6	0.9	1.1
E3		7.1	6.6	0.5	0.7
E4		124.0	115.3	9.6	12.0
E5		51.3	47.7	4.0	4.9
E6		41.3	38.4	3.2	4.0
E7		53.1	49.3	4.1	5.1
E8		58.5	54.4	4.5	5.6
E9		118.6	110.3	9.2	11.4
E10		68.0	63.2	5.2	6.6
E11		51.2	47.6	3.9	4.9
E12		277.7	258.3	21.4	26.8
E13		117.9	109.6	9.1	11.4
E14		144.4	134.3	11.1	13.9
E15		61.1	56.8	4.7	5.9
E16		67.7	62.9	5.2	6.5
E17		55.8	51.9	4.3	5.4
E18		26.9	25.0	2.1	2.6

Table 71: Deposition Calculation - Grassland – Gasifier and Biogas engines – Proposed Facility

ID	Site	Deposition (kg/ha/yr)				Total N Deposition (kg/ha/yr)	Acid Deposition (keq/ha/yr)	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
E1		0.006	0.078	0.052	0.022	0.029	0.002	0.006
E2		0.002	0.020	0.013	0.006	0.007	0.001	0.002
E3		0.001	0.012	0.008	0.004	0.005	0.000	0.001
E4		0.018	0.218	0.147	0.062	0.080	0.006	0.018
E5		0.007	0.090	0.061	0.026	0.033	0.002	0.007
E6		0.006	0.073	0.049	0.021	0.027	0.002	0.006
E7		0.008	0.093	0.063	0.027	0.034	0.002	0.008
E8		0.008	0.103	0.069	0.029	0.038	0.003	0.008
E9		0.017	0.209	0.140	0.059	0.077	0.005	0.017
E10		0.010	0.120	0.080	0.034	0.044	0.003	0.010
E11		0.007	0.090	0.061	0.026	0.033	0.002	0.007
E12		0.040	0.489	0.329	0.139	0.179	0.013	0.040
E13		0.017	0.207	0.139	0.059	0.076	0.005	0.017
E14		0.021	0.254	0.171	0.072	0.093	0.007	0.021
E15		0.009	0.108	0.072	0.031	0.039	0.003	0.009
E16		0.010	0.119	0.080	0.034	0.044	0.003	0.010
E17		0.008	0.098	0.066	0.028	0.036	0.003	0.008
E18		0.004	0.047	0.032	0.013	0.017	0.001	0.004

Table 72: Deposition Calculation - Woodland – Gasifier and Biogas engines – Proposed Facility

ID	Site	Deposition (kg/ha/yr)				Total N Deposition (kg/ha/yr)	Acid Deposition (keq/ha/yr)	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
E1		0.013	0.156	0.126	0.033	0.046	0.003	0.013
E2		0.003	0.040	0.032	0.009	0.012	0.001	0.003
E3		0.002	0.025	0.020	0.005	0.007	0.001	0.002
E4		0.036	0.436	0.352	0.093	0.129	0.009	0.037
E5		0.015	0.181	0.146	0.039	0.053	0.004	0.015
E6		0.012	0.145	0.117	0.031	0.043	0.003	0.012
E7		0.015	0.187	0.151	0.040	0.055	0.004	0.016
E8		0.017	0.206	0.166	0.044	0.061	0.004	0.018
E9		0.034	0.418	0.337	0.089	0.123	0.009	0.036
E10		0.020	0.239	0.193	0.051	0.071	0.005	0.020
E11		0.015	0.180	0.145	0.038	0.053	0.004	0.015
E12		0.080	0.978	0.789	0.209	0.289	0.021	0.083
E13		0.034	0.415	0.335	0.089	0.122	0.009	0.035
E14		0.042	0.508	0.410	0.108	0.150	0.011	0.043
E15		0.018	0.215	0.174	0.046	0.064	0.005	0.018
E16		0.019	0.238	0.192	0.051	0.070	0.005	0.020
E17		0.016	0.197	0.159	0.042	0.058	0.004	0.017
E18		0.008	0.095	0.076	0.020	0.028	0.002	0.008

Table 73: Nitrogen Deposition - Proposed Facility

ID	Site	NCL Class	Lower CL (kgN/ha/yr)	Upper CL (kgN/ha/yr)	Background (kgN/ha/yr)	PC (kgN/ha/yr)	Process Contribution		Predicted Environmental Concentration	
							% of Lower CL or Bg	% of Upper CL	% of Lower CL	% of Upper CL
1	South West London Water Bodies	No comparable habitat with established critical load estimate available	-	-		0.029	-	-	-	-
2	Thames Basin Heaths	Dry Heaths	10	20	15.3	0.007	0.07%	0.04%	15.3	153.1%
2	Thames Basin Heaths	Coniferous Woodlands	5	15	27.5	0.012	0.24%	0.08%	27.5	550.2%
3	Thursley Ash Pirbright and Chobham Common	"Valley mires, poor fens and transition mires	10	15	15.3	0.005	0.05%	0.03%	15.3	153.0%
3	Thursley Ash Pirbright and Chobham Common	Dry heaths	10	20	15.3	0.005	0.05%	0.02%	15.3	153.0%
3	Thursley Ash Pirbright and Chobham Common	Northern wet heath: Erica tetralix dominated wet heath	10	20	15.3	0.005	0.05%	0.02%	15.3	153.0%
4	Ash Link LNR	Grassland	10	15	15.1	0.080	0.80%	0.53%	15.2	151.8%
5	Desborough Island LWS	Grassland	10	15	14.8	0.033	0.33%	0.22%	14.8	148.3%
6	Littleton Lake LWS	Grassland	10	15	15	0.027	0.27%	0.18%	15.0	150.3%
7	Ferris Meadows LWS	Grassland	10	15	15	0.034	0.34%	0.23%	15.0	150.3%
8	Charlton Quarry LWS	Grassland	10	15	15.1	0.038	0.38%	0.25%	15.1	151.4%
9	Sunbury Park LWS	Grassland	10	15	14.9	0.077	0.77%	0.51%	15.0	149.8%
10	Queen Mary Reservoir LWS	Grassland	10	15	15.1	0.044	0.44%	0.29%	15.1	151.4%
11	Littleton Lake - Shepperton Green Reservoir LWS	Grassland	10	15	15	0.033	0.33%	0.22%	15.0	150.3%
12	Ashford Plant LWS	Grassland	10	15	15.1	0.179	1.79%	1.19%	15.3	152.8%
13	River Ash: Shepperton Green LWS	Grassland	10	15	15	0.076	0.76%	0.51%	15.1	150.8%
14	River Ash: Splash Meadow LWS	Grassland	10	15	15	0.093	0.93%	0.62%	15.1	150.9%
15	River Ash: Gaston Bridge to Watersplash Farm LWS	Grassland	10	15	15	0.039	0.39%	0.26%	15.0	150.4%
16	River Ash: Splash Meadow to Gaston Bridge LWS	Grassland	10	15	15	0.044	0.44%	0.29%	15.0	150.4%
17	River Thames - Elmbridge LWS	Grassland	10	15	15	0.036	0.36%	0.24%	15.0	150.4%
18	River Thames - Spelthorne LWS	Grassland	10	15	15	0.017	0.17%	0.12%	15.0	150.2%

Table 74: Acid Deposition - Proposed Facility

ID	Site	Acidity class	Min CL (CLmaxN)	Max CL (CLmaxN)	Background		Process Contribution				Predicted Environmental Concentration	
					N (kgN/ha/yr)	S (kgS/ha/yr)	N (kg/ha/yr)	S (kgS/ha/yr)	% of Lower CL	% of Upper CL	% of Lower CL	% of Upper CL
1	South West London Water Bodies	Broad Habitat	-	-	-	-	0.002	0.006	-	-	-	-
2	Thames Basin Heaths	No expected negative impact on the species due to impacts on the species' broad habitat.	-	-	-	-	0.001	0.002	-	-	-	-
3	Thursley Ash Pirbright and Chobham Common	Not sensitive to acidity	0.532	0.676	1.33	0.19	0.000	0.001	0.3%	0.2%	286.0%	225.1%
3	Thursley Ash Pirbright and Chobham Common	Bogs	0.872	2.404	1.33	0.19	0.000	0.001	0.2%	0.1%	174.5%	63.3%
3	Thursley Ash Pirbright and Chobham Common	Dwarf shrub heath	0.872	2.404	1.33	0.19	0.000	0.001	0.2%	0.1%	174.5%	63.3%
4	Ash Link LNR	Dwarf shrub heath	4.856	-	1.07	0.16	0.006	0.018	0.5%	-	25.8%	-
5	Desborough Island LWS	Calcareous grassland	4.856	-	1.07	0.16	0.002	0.007	0.2%	-	25.5%	-
6	Littleton Lake LWS	Calcareous grassland	4.856	-	1.07	0.16	0.002	0.006	0.2%	-	25.5%	-
7	Ferris Meadows LWS	Calcareous grassland	4.856	-	1.07	0.16	0.002	0.008	0.2%	-	25.5%	-
8	Charlton Quarry LWS	Calcareous grassland	4.856	-	1.07	0.16	0.003	0.008	0.2%	-	25.6%	-
9	Sunbury Park LWS	Calcareous grassland	4.856	-	1.07	0.16	0.005	0.017	0.5%	-	25.8%	-
10	Queen Mary Reservoir LWS	Calcareous grassland	4.856	-	1.07	0.16	0.003	0.010	0.3%	-	25.6%	-
11	Littleton Lake - Shepperton Green Reservoir LWS	Calcareous grassland	4.856	-	1.07	0.16	0.002	0.007	0.2%	-	25.5%	-
12	Ashford Plant LWS	Calcareous grassland	4.856	-	1.07	0.16	0.013	0.040	1.1%	-	26.4%	-
13	River Ash: Shepperton Green LWS	Calcareous grassland	4.856	-	1.07	0.16	0.005	0.017	0.5%	-	25.8%	-
14	River Ash: Splash Meadow LWS	Calcareous grassland	4.856	-	1.07	0.16	0.007	0.021	0.6%	-	25.9%	-
15	River Ash: Gaston Bridge to Watersplash Farm LWS	Calcareous grassland	4.856	-	1.07	0.16	0.003	0.009	0.2%	-	25.6%	-
16	River Ash: Splash Meadow to Gaston Bridge LWS	Calcareous grassland	4.856	-	1.07	0.16	0.003	0.010	0.3%	-	25.6%	-
17	River Thames - Elmbridge LWS	Calcareous grassland	4.856	-	1.07	0.16	0.003	0.008	0.2%	-	25.5%	-
18	River Thames - Spelthorne LWS	Calcareous grassland	4.856	-	1.07	0.16	0.001	0.004	0.1%	-	25.4%	-

E Detailed Results Tables – Change in Impact at Ecological Sites

Table 75: Change Impact at Ecological Sites

ID	Site	Oxides of nitrogen (µg/m³)		Sulphur dioxide (µg/m³)	Hydrogen fluoride (µg/m³)		Ammonia (µg/m³)
		Annual mean	Daily mean	Annual mean	Weekly mean	Daily mean	Annual mean

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